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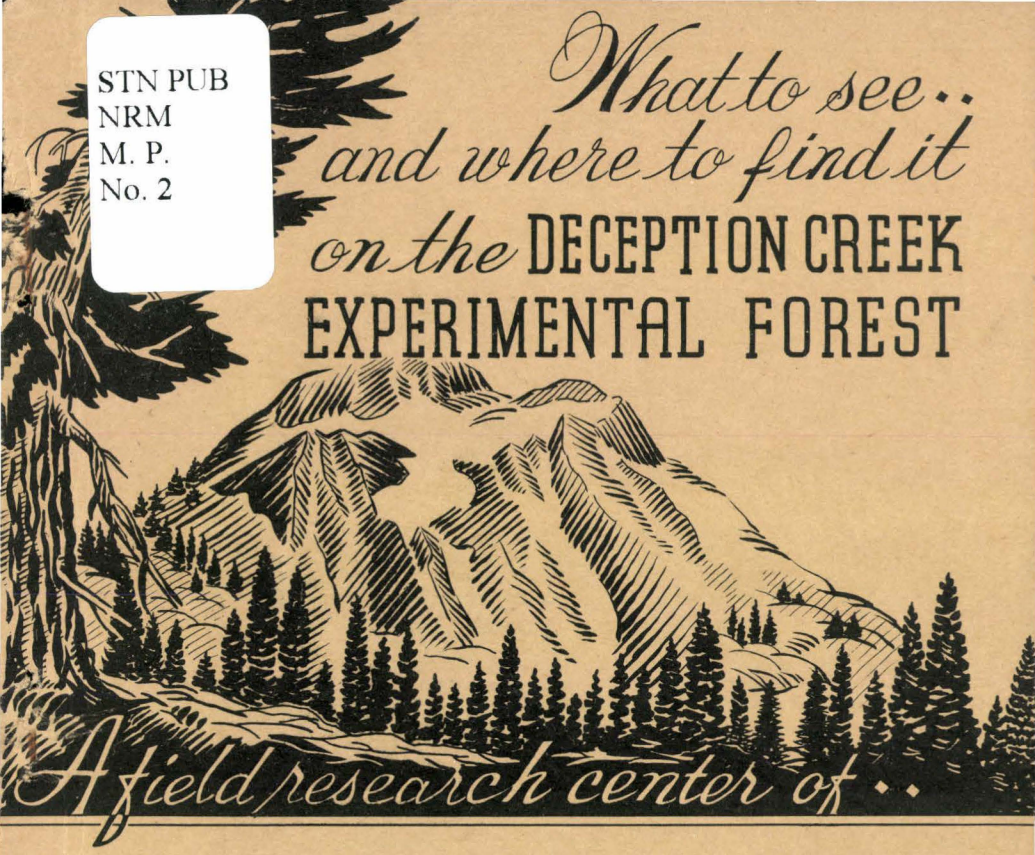
What to see.. and where to find it on the DECEPTION CREEK EXPERIMENTAL FOREST



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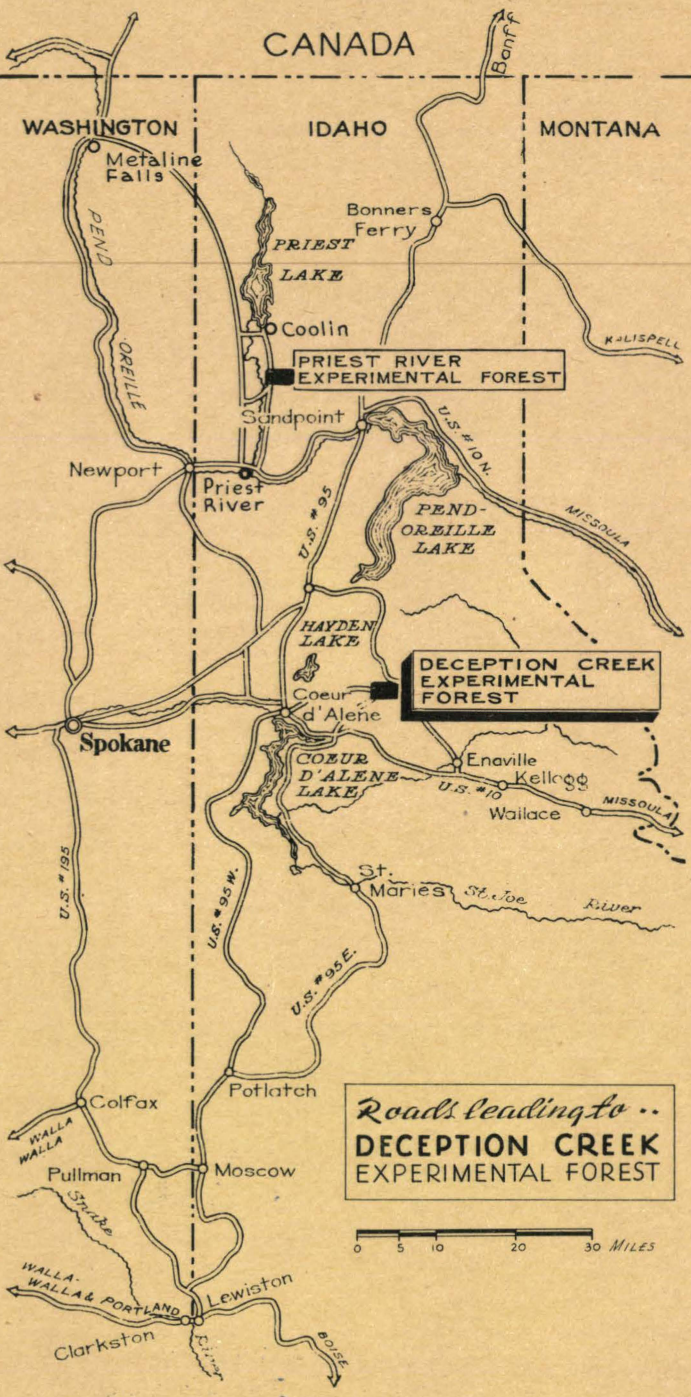

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WHAT TO SEE AND WHERE TO FIND IT ON THE DECEPTION CREEK EXPERIMENTAL FOREST 1/

By

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Northern Rocky Mountain Forest and Range Experiment Station

Miscellaneous Publication No. 2
May 1951

This booklet is intended to help you see and understand research in progress on the Deception Creek Experimental Forest. It gives information on purposes, methods, and results of each of our main experiments. Details on some of these studies are posted in "bulletin board" signs located on the experimental area, or can be obtained from resident personnel. Copies of published information on some experiments can be obtained at the Experimental Forest headquarters or from the Northern Rocky Mountain Forest and Range Experiment Station at 157 South Howard Street, Spokane, Washington, and Missoula, Montana.

The Forest superintendent or members of the investigative staff working on the Forest will be glad to show you around. This booklet has been so arranged, however, that with its aid you can find your way without a guide, if you prefer, and see and study the various experimental areas in as much detail as you wish.

1/ Much of the information contained in this booklet appeared in an earlier processed publication which bore the same title, May, 1940, and in "A guide to Deception Creek Experimental Forest", January, 1938.

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A FIELD LABORATORY AND DEMONSTRATION AREA FOR MANAGEMENT AND SILVICULTURAL RESEARCH IN THE WESTERN WHITE PINE TYPE.. HARVEST CUTTING. SLASH DISPOSAL. REGENERATION. PLANTING, DIRECT SEEDING, PRUNING, WEEDING AND THINNING..

PURPOSE AND HISTORY OF THE DECEPTION CREEK EXPERIMENTAL FOREST

Dedicated to the development of better timber growing methods in the western white pine forest type, the Deception Creek Experimental Forest is maintained for research and demonstration purposes by the Northern Rocky Mountain Forest and Range Experiment Station of the Forest Service, U. S. Department of Agriculture. The chart on the opposite page shows where the Experimental Forest fits into the United States Forest Service organization. The Experimental Forest is located in the Coeur d'Alene National Forest, 22 miles east by road from Coeur d'Alene, Idaho from which it can be reached by automobile in about one hour.

At present, timber management research is the principal activity on the Experimental Forest. The Forest headquarters and other Forest facilities are available, however, to other research activities of the Northern Rocky Mountain Forest and Range Experiment Station and to cooperating agencies. The U. S. Fish and Wildlife Service, the Division of Forest Pathology of the Bureau of Plant Industry, Soils, and Agricultural Engineering, and the University of Idaho Forestry School all have studies on the tract.

The Deception Creek Experimental Forest was established in 1933. The headquarters improvements were chiefly constructed the following year under the NIRA and CCC public works programs. The only road through the Forest at the time of its establishment was the old Wolf Lodge road which comes down Sands Creek past the Forest headquarters. The present network of protection and utilization roads has been built mainly through the CCC program and timber sales.

An area of 160 acres surrounding the headquarters was at one time a homestead claim. Most of the white pine within that claim was cut in 1914 and 1915 leaving a heavy residual stand of grand fir and hemlock. The young white pine trees immediately surrounding the headquarters buildings came in following clearing of the land around the old homestead buildings, from about 1905 to 1910.

Several early sales by the Forest Service in the Deception Creek drainage, prior to establishment of the Experimental Forest, added to its value for research purposes. In 1909 an area of about 10 acres was logged on the south side of Deception Creek on the east boundary of the Experimental Forest. In 1910 some 30 acres, mostly in Ames Creek, were clear cut in narrow strips as an administrative experiment by the Coeur d'Alene National Forest. In 1916 and 1917 about 110 acres in Sands Creek were cut in a Forest Service timber sale. Only white pine was logged and from 8 to 12 white pine trees per acre were reserved to reseed the area. These early cuttings on the Experimental Forest have been of much value as examples of certain practices, both good and bad, and have furnished an opportunity for the testing of timber stand improvement measures.

DESCRIPTION OF THE FOREST

The Experimental Forest is representative of the central portion of the Inland Empire western white pine type. It includes the entire drainage of Deception Creek, a tributary of the North Fork of the Coeur d'Alene River and has an area of 3517 acres. Elevation ranges from about 2800 feet above sea level at the creek bottom to a little over 4600 feet on the ridge tops. Almost all of the tract is forested and capable of producing merchantable timber. Its timber stands are composed of a variable but characteristic association of the highly valuable western white pine (Pinus monticola) with the less commercially desirable western larch (Larix occidentalis), Douglas-fir (Pseudotsuga taxifolia), grand fir (Abies grandis), and western hemlock (Tsuga heterophylla), and small numbers of Engelmann spruce (Picea engelmanni), and lodgepole pine (Pinus contorta). As estimated in 1934, merchantable timber volumes on the Experimental Forest were as follows:

Species	Volume in board feet (Scribner rule)
Western white pine	36,970,000
Western larch	3,990,000
Douglas-fir	8,250,000
Grand fir	9,148,000
Western hemlock	4,228,000
Engelmann spruce	309,000
Others	571,000
Total	63,466,000

Since establishment of the Experimental Forest, timber has been cut at the rate of nearly a million board feet a year. Although these cuttings are largely experimental, being designed to test various cutting methods, they are conducted as regular logging operations. The timber is sold to the highest bidder and logged in accordance with a specific cutting plan. The results of these cuttings are closely observed. Another purpose of cutting is to improve the usefulness of the Experimental Forest as a management unit by reducing the overly large proportion of mature timber. From 1933 through 1950, a little more than 15,766,000 board feet of timber has been cut, bringing in $85,250 to the government for stumpage and additional amounts for slash disposal and sale area betterment.

The Experimental Forest is included in the intensive fire protection program of the Coeur d'Alene National Forest. The National Forest staff also maintains the trails and roads, supervises blister rust and insect control, and administers the timber sales.

INVESTIGATIVE PROJECTS

Field experiments on the Experimental Forest are on a sufficiently large scale to make effective visual demonstrations, and in most instances sample plots have been established to measure results. Most of the experiments are shown by area number on the map opposite the next page. Facing the map is an index by area number which gives the subject matter of each experiment and also the page where the particular area is described.

Subject matter guide to the numbered experimental areas.

Subject	Area number
Harvest cuttings of mature timber	
Clear cuttings	1, 11, 15, 22
Alternate clear-cut and shelterwood strips	11, 15, 22
Seed tree cuttings	2, 24
Shelterwood cuttings	11, 17, 21, 22
Selective cuttings	16
Partial cuttings	23, 25, 27
Salvage cuttings	28
Stand improvement	
Weedings or cleanings	2, 13, 24
Thinnings and improvement cuttings	6, 19, 20, 26
Pruning	14, 20
Defective tree disposal	1, 2, 3, 4, 10, 11, 12, 13, 16, 17, 18, 21
Artificial regeneration	
Direct seeding	1, 4
Planting	1, 10
Protection	
Pole blight	7, 31
Blister rust	31, 32
Miscellaneous	
Growth and yield	5, 8
Weather station and snow courses	9
Small mammals census	30
Natural area	29

INDEX TO NUMBERED AREAS ON MAP

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3	Disposal of valueless understory hemlock	11
4	Direct seeding a broadcast burn	13
5	Winter damage in white pine pole stands	15
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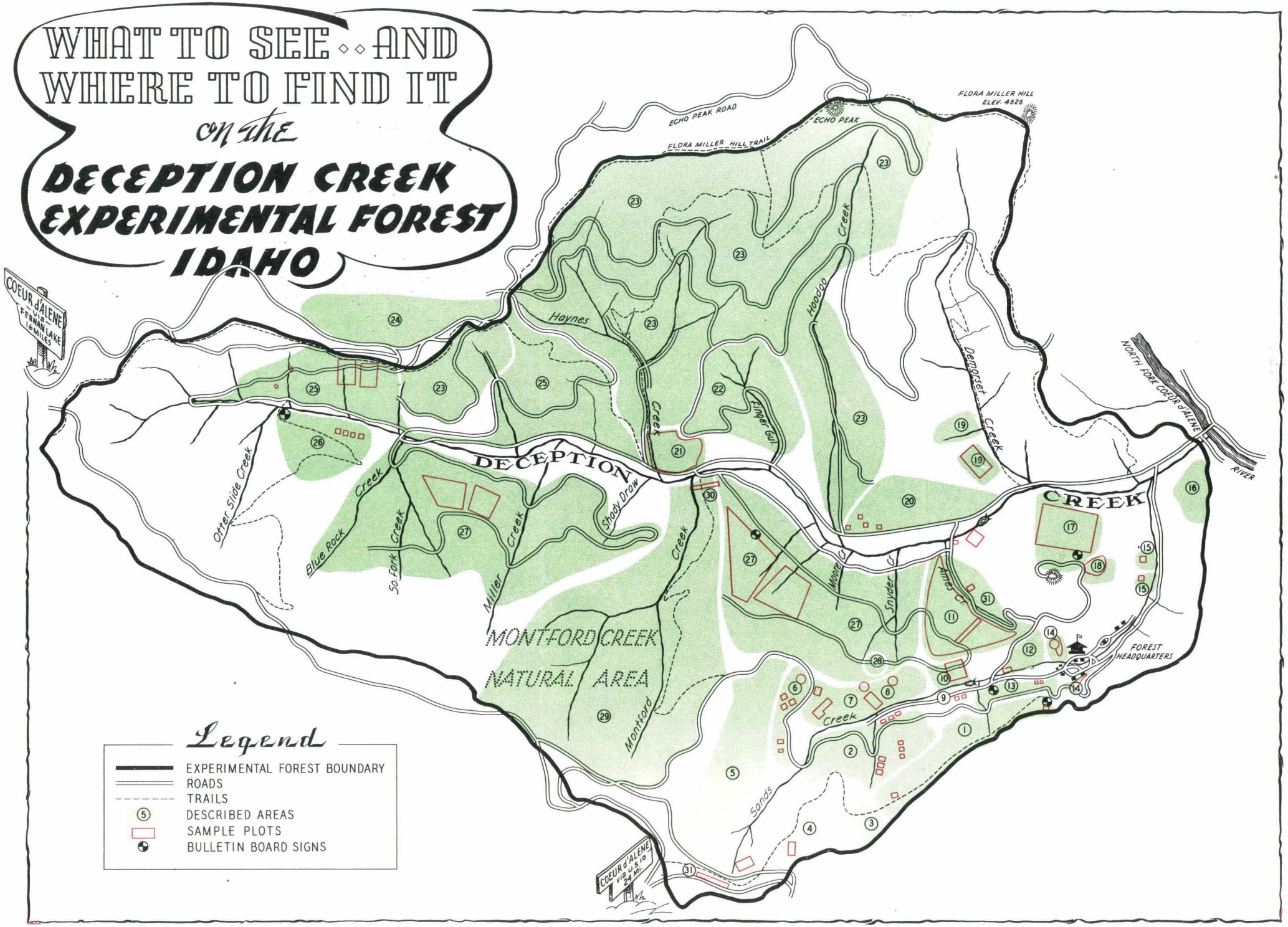

WESTERN WHITE PINE PLANTATIONS
Area 1

Located as shown on the index map are 41 acres of western white pine plantations established in 1935, 1936, 1937, and 1938 in this order as you go west up the ridge.

The original stand on this unit was about half western white pine and half other species which were defective and unmerchantable. All merchantable white pines were logged and the remaining stand was then clear cut and broadcast burned shortly before planting the tract. If the residual stand had not been removed, the area, which is good for timber growing, would have remained commercially unproductive almost indefinitely. The block of green timber just downhill from the ⓘ on the map is a sample of what the stand looked like before treatment; green and a forest, but commercially valueless. The effectiveness of the drastic clean cutting and burning treatment in restoring such lands to productivity is demonstrated by the thrifty and vigorous white pine plantation now occupying the site. Such areas do not long remain black after burning; they revegetate rapidly.

The area was planted in May and early June of 1935, 1936, 1937, and 1938, with 2-2 western white pine (planting stock grown two years in the seed bed and two years in the transplant bed). Survival has in general been very good. One year after planting survival was as follows: 1935 plantation, 88 percent; 1936, 56 percent brought up to 89 percent by replanting in 1937; 1938, 88 percent. Only the 56 percent survival of 1936, an exceptionally dry year, was unsatisfactory. Further information on these plantations is posted in the bulletin board sign.

Where the ⓘ shows on the map is a demonstration experiment of tree spacing in plantations. As identified by metal tags on cedar posts along the trail, trees were spaced 4 x 4 feet, 6 x 6 feet, and 8 x 8 feet. In national forest plantings, trees ordinarily are spaced about 7 x 7 feet. The closer and wider spacings are under test here to determine the effect of density on plantation development.

Along the trail near the upper (western) end of the area are two experiments in direct seeding, established in the fall of 1937 and the spring of 1938. These installations furnished valuable background information used in further research. It was found that in sowing, the larger kinds of seed, including white pine, must be protected from rodents, principally mice. Rodents were excluded from half the spots sown in these plots by conical wire screens. On the screen-protected white pine spots, sown in the fall, one or more seedlings were alive after the first growing season on 85 percent of the spots while of the unscreened spots only 37 percent contained seedlings. Stocking had dropped by the end of the fifth

growing season to 60 percent for screened and 31 percent for unscreened spots. Engelmann spruce, a small seeded species, succeeded better on both screened and unscreened spots, being stocked 93 and 86 percent respectively at the end of the first growing season and 74 and 68 percent at the end of the fifth.

At this point in the trail just above the direct seeding tests, you can see a good comparison between the height growth of nursery propagated trees and those started by direct seeding. The trees above the trail, which originated in a nursery, are considerably taller than the direct-seeded trees below the trail, yet the same number of years has elapsed since field planting.

Each winter these plantations are covered by deep snow which sometimes freezes on the small trees. In the spring the pressure of the settling snow pack often tears branches from the main stem. The appearance of the broken branches and the resulting wounds is similar to that of branches wrenched off by hand. Snow damage is visible from the trail.

The plantations suffered an unusual type of damage in 1948. A hail storm caused severe defoliation, breakage of leaders and branches, and bruising on the stems and branches. During the summer bruises widened and became open wounds but by spring of the following year they were beginning to heal. In some cases the year's growth was lost or retarded, and many stems were deformed, but outright mortality has been light.

A few trees have died from white pine blister rust infections, but the percentage of loss by blister rust has not reduced stocking greatly enough to affect eventual yields. Little new blister rust infection will occur because the tract is now protected from further attack.

Small patches of dead trees, killed by root-rotting fungi, can be seen throughout the plantations. The most common of these fungi is Armillarea mellea, a root parasite that spreads by means of shoestring-like growths radiating through the soil.

WEEDING NATURAL REPRODUCTION FOLLOWING A SEED TREE CUTTING
Area 2

The generally excellent stocking of natural reproduction on this area originated after a seed tree cutting between 1916 and 1920.

The tract is one of the few in the western white pine region where a mature virgin stand has been harvested and excellent reproduction developed under rather intensive management. The cutting was one of the early administrative experiments of the Coeur d'Alene National Forest. A rather dense 160-year-old stand with a gross volume of about 50 thousand board feet per acre, between 50 and 60 percent white pine, was logged from 1916 to 1920, leaving four to six medium or large white pine seed trees per acre. The seed trees constituted five percent of the merchantable volume of white pine. In addition, all white pine trees less than 12 inches in diameter were reserved. The rather heavy stand of other species, mainly grand fir and western hemlock, both defective and unmerchantable, left after logging the pine was killed by girdling. Though girdling killed the trees cheaply and effectively, so great a fire hazard in dead snags was created that many a forester squirmed uneasily as he rode through the area on the old Wolf Lodge road. The area was literally gray with snags until 1933 when they were felled and most of the dead material near the road was piled and burned.

But hazard or not, a very satisfactory stocking of natural reproduction developed under the white pine seed trees and girdled snags. In 1925 there were about 7800 seedlings per acre, nearly 1000 of which were white pine. While the young white pines were ample in numbers to stock the land adequately, they were being severely crowded and suppressed by vigorous hemlock and grand fir which thrive on moist and protected north slopes, especially when partially shaded by overwood.

Crowding and shading of the young white pine was remedied in 1935 and 1936, soon after the establishment of the Experimental Forest. The valuable white pine seed tree stand of 7 to 10 thousand board feet per acre (15 to 20 trees) which had served its purpose was commercially logged and the reproduction was weeded to release the white pine. Weeding, which required three to five CCC man days per acre, effectively put the white pines into dominant positions.

Three sets of permanent sample plots were established within the tract to measure results of the weedings. Each set of plots includes one unweeded control or "check" plot and two weeded plots. All plots are one-tenth acre in size.

The sample plots were remeasured in 1945, 10 years after weeding. Some of the findings are summarized in the tabulation below.

Plot number and treatment	White pine in dominant stand (1945)	Average height of crop trees (1945)	Average diameter at breast height of crop trees (1945)
	Percent	Feet	Inches
49 weeded	70	14.6	2.7
50 weeded	59	12.8	2.4
51 unweeded	24	12.0	1.8
52 weeded	42	5.9	0.7
54 weeded	45	9.3	1.6
53 unweeded	11	5.8	0.6
55 weeded	72	16.0	2.8
56 weeded	64	19.1	3.6
57 unweeded	24	11.9	1.8
Average weeded plots	59	13.0	2.3
Average unweeded plots	20	9.9	1.4

As a result of the weedings there were almost three times as many white pine trees in the dominant stand on the weeded plots as on the unweeded plots 10 years later. Moreover, the trees which were picked out to be the final "crop trees" on the weeded plots were 1.3 times as tall and 1.6 times bigger in d.b.h. as similar trees on the unweeded plots.

A second light weeding 5 to 10 years after the first weeding would have further increased the percentage of dominant white pine.

The next step in the management should be pruning of crop trees to obtain maximum quality growth. Tests have shown that pruning is cheaper and more efficient if started when the stems and branches are small.

DISPOSAL OF VALUELESS UNDERSTORY HEMLOCK
Area 3

About 1870 a large forest fire swept across the head of Sands Creek. In the path of the main fire the original stand was almost completely killed but was promptly replaced by a good natural stand of western white pine and commonly associated trees. Area 3 is on the edge of this early holocaust where the fire finally fizzled out, killing only part of the old stand.

Where the fire killed only part of the timber, it opened the stand enough to induce abundant natural reproduction but not enough to let this reproduction grow properly. Consequently, a young stand of great density developed under the partially opened parent stand. The parent stand was choked by the dense undergrowth of young trees. Neither the overwood nor understory trees could do much more than persist. The reproduction probably once included a good proportion of white pine, but this species was long ago eliminated by the more shade-enduring western hemlock.

One way to break the impasse was to cut the reproduction and begin again. In 1938, the reproduction on $3\frac{1}{2}$ acres was slashed, piled in windrows and burned. What the stand originally looked like can be seen from the untreated tract to the west. Eliminating the tangle of understory trees was an expensive job; it required about 50 CCC man days per acre. No such investment could be made on a practical basis. The condition that resulted from the fire on Area 3 should be a lesson about the consequences of certain kinds of partial cutting. When reproduction is established this time, its composition will be regulated by timely and inexpensive weeding. The parent stand, which is mostly white pine (somewhat damaged by the fire), will be commercially logged before it begins to suppress the reproduction.

This tract provides an opportunity for comparing natural regeneration with planting and direct seeding. The 1937 and 1938 plantations and direct seedings in Area 1 are situated directly to the east. Ten years after field planting of nursery propagated trees, the tract was fully stocked with trees six to eight feet in height. The direct-seeded unit was also well stocked with trees three to four feet in height, but the stocking of natural regeneration on Area 3 was still inadequate and few trees were as much as one foot in height. Establishment of the natural reproduction on Area 3 has been slow, in fact, much slower than usual because of a series of poor seed years following the cutting. Stocking increased sharply following the good seed crops in 1947 and 1948. When a full stand is established on Area 3 it will be far behind the neighboring planted and direct-seeded stands in growth and development.

DIRECT SEEDING A BROADCAST BURN
Area 4

This 11-acre tract was clear cut of merchantable white pine in the summer of 1936. Logging left a stand of defective and unmerchantable timber, mostly small understory trees that contained little material of saw-timber size. The residual timber was felled in the summer of 1938 and broadcast burned the same year in early autumn.

Instead of planting trees, which is a more common practice on slashed and burned areas, this tract was seed spotted with western white pine shortly after the autumn broadcast burn. Before planting, the seeds had been poison-coated with a mixture of strychnine, plaster of paris, yellow dextrine, and cornmeal. They were planted in small spots eight feet apart, about 20 seeds to the spot. Ashes and duff were scraped from the spots and the exposed mineral soil was stirred slightly when the seeds were planted. The poison coating was furnished for the benefit of mice which, if unmolested, will eat most of the seed almost as soon, literally, as the planter's back is turned. Sunflower seed poisoned with thallium sulfate was also distributed over the area about a week before sowing as a preliminary measure for elimination of rodents. Later tests have shown that pre-poisoning with sunflower seed is sufficient, and poison-coating the tree seeds is unnecessary.

The direct-seeding experiment has been very successful. One or more seedlings germinated on 93 percent of the spots and one year later one or more seedlings were alive on 85 percent of the spots. Ten years after sowing, 76 percent of the spots were still stocked. The trees are now getting their heads above the brush and will grow increasingly faster.

One possible disadvantage of the seed spotting method is that several seedlings may become established in a single place and compete with each other too much for best growth. Competition of this kind has not been severe on Area 4 because most of the spots have only one seedling, or one seedling per spot has definitely dominated. However, competition may lessen growth seriously in some places so tests of the effect of density within seed spots on height and diameter growth have been started. Results to date show that the number of seedlings per seed spot has had little effect on height growth but higher densities cause some reduction in diameter growth. (See Station Research Note No. 58.)

Direct seeding of western redcedar was also tested on Area 4. In the fall of 1938, nine small plots of 25 seed spots each were sown with redcedar. One or more seedlings germinated on 98 percent of the seed spots. One year later 91 percent of the spots contained seedlings, and 10 years after sowing 70 percent of the spots were still stocked. This experiment, with similar tests on other areas, has demonstrated that western redcedar can be successfully regenerated by the seed spotting method.

WINTER DAMAGE IN WHITE PINE POLE STANDS
Area 5

Growth of forests in the western white pine type is sometimes greatly retarded by natural damaging agents. The hail damage on Area 1 is an example. More frequently snow and wind damage stands. The uncertainty of such forms of damage, especially on small areas and over short periods, impedes accurate prediction of future yields. Area 5 illustrates this problem.

Area 5 contains about 80 acres of pole-size timber on an upper north slope. In 1948, in terms of basal area, the stand was composed of approximately 60 percent white pine, 30 percent grand fir, and 10 percent other species. The total basal area of 220 square feet per acre represented 85 percent stocking in terms of a theoretical "normal", or full stocking. The average stand age in 1948 was 75 years. Snow and wind heavily damaged the stand during the winter of 1948-49. Some winter damage is apt to happen on these upper slopes almost every year, but 1948 damage was unusually severe.

Within Area 5 is a permanent sample plot two acres in size which was established in 1923 and has been measured at five-year intervals since that date. As it had been remeasured in the fall of 1948, a tally of mortality in the spring of 1949 gave an accurate measure of the damage that had occurred during the winter. The tally showed that 37 percent of the trees, 33 percent of the basal area, and 30 percent of the cubic foot volume had been destroyed. Cubic volume had been set back 20 years and basal area even more. In fact, the basal area on the plot was less in 1949 than at the time the plot was established in 1923. Stocking, in terms of "normal" dropped from 85 percent in the fall of 1948 to 58 percent in the spring of 1949. Over 2000 cubic feet of timber per acre were lost.

All species and all crown classes were damaged. A number of temporary one-tenth-acre plots sampling the whole area showed that 25 percent of the dominant and codominant trees and 20 percent of the intermediate and suppressed trees were killed. About one-third of the fatalities were caused by uprooting and two-thirds by breakage of the bole. The losses were about the same for all species.

THINNING 70-YEAR-OLD WHITE PINE
Area 6

Following a severe fire which swept the upper end of Sands Creek about 80 years ago, the burned area seeded in heavily to reproduction dominated largely by the valuable western white pine. In 1933, 1934, and 1935 about 15 acres of this area were thinned experimentally to test the effects of reducing density and increasing the percentage of white pine.

The unthinned stand was very dense--about 1500 trees per acre with a basal area of between 250 and 300 square feet. The timber on much of Area 6 was thinned to about 400 of the best trees per acre (mostly white pine) with a basal area of 150 square feet per acre. The proportion of white pine in the dominant stand was increased from about 70 percent before thinning to nearly 90 percent after thinning. Most of the heavy slash created by thinning was dragged down to the road and burned.

The effects of this thinning are being studied on a series of sample plots established in 1933. Results obtained from an examination of these plots in 1943, 10 years after thinning, are not very promising. The average annual diameter growth of trees in the thinned plots was not materially different than that of trees in adjoining unthinned check plots. Height growth also was little affected by thinning during the 10-year period. Tree mortality, caused mostly by snow breakage, was heavier in the thinned than in the unthinned area. As a result, the volume was greater in the unthinned stand 10 years after treatment even when only trees were counted which would have been left had the stand been thinned.

Although the thinned stand makes a fine appearance, results so far do not indicate thinnings in such stands to be financially practicable unless the trees cut can be marketed in order to defray at least part of the cost of thinning. Because the original stand was already dominated by white pine and growing fairly well, it would normally produce high values at maturity without any assistance. At present there is no market for the products of such thinnings. If, as is anticipated, markets for smaller trees improve in the future the results of this thinning research, which necessarily takes much time to get, will become of value.

The white pine on Area 6 has been heavily damaged by pole blight, a newly discovered disease of western white pine pole stands, the cause of which is yet unknown. As the plots in this area were established prior to the invasion by pole blight, the records of individual trees in the plots may be of scientific

use for tracing rate of spread of the disease and amount of resulting damage. For example, in 1943 pole blight was not known to exist in this area. An examination in 1948 of one of the quarter-acre sample plots showed that 19 percent of the trees had been killed and an additional 23 percent were visibly affected by the disease.

POLE BLIGHT OF WESTERN WHITE PINE
Area 7

Pole blight is a relatively new disease of pole-size western white pine trees, having been first observed in 1929. It attacks trees of any crown class, but is confined primarily to the dominant and codominant trees. White pine is generally believed to be the only susceptible species.

The most noticeable symptom of pole blight is a yellowing of the foliage on groups of white pine trees or of isolated individuals. Closer inspection shows foliage thinning beginning in the upper crown and extending progressively downward. Stunting of needle growth, reduction in leader growth, and flow of resin through the bark along the trunk, anywhere from the base of the tree well into the crown, are additional symptoms. The resin flow comes from lesions which may range in length from a few inches to several feet. The cambium beneath these lesions is dead and the underlying wood commonly pitch-soaked.

Pole blight damage surveys made by the Division of Forest Disease Research from 1949 through 1955 showed that pole blight has caused moderate to severe damage in about 95,000 acres of pole-size timber. It has been found in all parts of the western white pine type in the Inland Empire except for the southernmost portion of the St. Joe National Forest and the Clearwater National Forest. Several stands on the Deception Creek Experimental Forest have been severely damaged by pole blight, especially in Sands Creek and above Area 26 in upper Deception Creek. The most severe damage has occurred in Area 7 where the disease was first noticed in 1932.

Damage and loss appraisal surveys in diseased stands completed in 1955 showed an average of 68 percent of the white pine basal area on 8 old diseased areas to be either diseased or dead. The range for these plots was 45 to 81 percent. On 40 survey plots in Sands Creek an average of 45.3 percent of the white pine basal area is diseased or dead. Pole blight is particularly serious because it attacks an age class that

is already scarce. Pole-size white pine is badly needed to fill the gap between the present old-growth timber a and the reproduction and sapling stands. If pole blight continues unabated it could severely impede continued production of white pine. An additional threat posed by the disease is its encroachment into blister rust control units, thus presenting a potential loss of white pine stands in which blister rust has been controlled.

The Deception Creek station has long served as a field laboratory and headquarters for those engaged in the study of pole blight. Since 1947, pole blight has been studied jointly by the U.S. Forest Service and the University of Idaho, and in Canada by the Canadian Division of Forest Biology. Research of the above agencies has included studies of fungi and insects; root, stem, and foliar analyses of healthy and diseased trees; possible adverse soil conditions; soil moisture and nutrient deficiencies; root system development and deterioration; rate of spread; effect on the remaining stand caused by cutting diseased trees; and surveys to determine occurrence and extent of damage.

Some of the more important findings to the present time are enumerated below:

1. Air pollution has not been determined to be the causal agent of pole blight.
2. Fertilization tests have yielded variable and inconsistent results.
3. Variations in nutrient uptake and accumulation patterns between healthy and diseased trees have been determined with radioactive tracer elements.
4. Grafting work has not been conducted for a sufficient time to indicate whether or not a transmissible virus is involved.
5. Thinning appears to hasten the deterioration of a stand subsequently attacked by pole blight. Neither thinning nor eradicating pole-blighted stems from diseased stands has proved beneficial in halting the progress of the disease.
6. Reduced radial growth is always associated with pole blight and precedes both crown decline and lesion development.
7. There is a significant relationship between the degree of rootlet deterioration and the severity of pole blight.

8. The severity of pole blight, expressed as affected basal area, is significantly related to effective soil depth, available water-holding capacity, and rootlet mortality.

9. Intensive field examination of soils in the white pine type may aid in the determination of those sites that are likely to remain relatively free of pole blight.

GROWTH AND YIELD OF WESTERN WHITE PINE
Area 8

Every forest manager who wants sustained production and high yields from his timber needs to know how fast it is growing. He needs growth information to determine when timber should be cut and how much timber can be cut each year without depleting the growing stock. Area 8 which includes permanent sample Plot 17, is part of a project aimed at solving problems of growth in white pine stands.

Foresters have a number of methods of determining the growth of forest stands. For short-time predictions, they sometimes take cores from trees by means of an increment borer. Past annual growth of a tree can be seen and is measured on the core and this growth rate, or trend, can be projected into the future.

Another common method is to measure the timber on a number of small temporary sample plots which are located in a wide range of age classes and site quality classes. Tables are derived from these measurements which show average stand volume and other statistics by age classes and site quality. These can be used to predict the growth of timber. Such tables have been prepared for the western white pine type and published as U.S.D.A. Technical Bulletin 323, "Second-growth yield, stand, and volume tables for the western white pine type", by I. T. Haig, 1932.

The surest method of learning about growth of stands is by periodic remeasurement of permanent sample plots. Plot 17 is one of many plots which the Experiment Station has established throughout the white pine forests in order to measure actual growth at intervals. Established in 1923, Plot 17 is one acre in size. Each tree 2.6 inches and greater in diameter at breast height has been numbered and identified with a metal tag attached to the tree with a nail. The plot is examined at five-year intervals at which time detailed measurements and observations are made for each tree.

The table on the next page gives the "vital statistics" for this plot. The heavy damage suffered by the plot since 1943 by pole blight is not shown in the table.

SUMMARY DATA FOR PLOT 17
Per acre

Age in 1923: 55 years (Includes all trees 2.6 inches d.b.h. and larger) Site index: 52 feet (at 50 years)

Species	Trees			Basal area			Total volume			Scribner volume		
	1923	1933	1943	1923	1933	1943	1923	1933	1943	1923	1933	1943
	No.	No.	No.	Sq.ft.	Sq.ft.	Sq.ft.	Cu.ft.	Cu.ft.	Cu.ft.	Bd.ft.	Bd.ft.	Bd.ft.
Western white pine	840	653	509	141	153	160	3265	4260	5047	4699	9389	15,435
Western larch	17	16	14	4	5	5	90	111	149	38	81	199
Douglas-fir	159	125	76	35	38	34	691	897	935	581	1179	2,442
Grand fir	515	443	338	53	59	61	1060	1292	1528	31	375	1,450
Western hemlock	5	5	6	1	1	1	19	27	36	0	42	71
Lodgepole pine	5	5	3	1	1	1	25	37	24	0	0	0
All species	1541	1247	946	235	257	262	5150	6624	7719	5349	11,066	19,597
Percent of normal				116	112	104	115	112	105	96	100	107

WEATHER STATION AND SNOW COURSES
Area 9

Weather Station

Weather and climate affect the practice of forestry in many ways. Climatic factors and extremes of weather often determine which species of trees will grow in a particular area. Even within a species climatic races are frequently recognized. Ponderosa pine, for example, has several such races. Weather plays a very important part in planning and directing forest fire protection. The spread of insect infestations and disease epidemics is favored or retarded by various elements of weather. An example is the so-called "wave years" of white pine blister rust infection. During wave years the weather favors production of rust spores and spread of the disease. Weather and climate are subject to little control or modification by man, but detailed weather records can explain many silvicultural and ecological reactions and hence are valuable tools in research.

Detailed, year-long weather measurements were made at the Deception Creek Station from 1936 through 1945. Since that time temperature, humidity, and precipitation have been recorded only during the summer field season. During the period when detailed measurements were made, Deception Creek usually recorded the greatest annual precipitation of any weather station in the State of Idaho. Measurements from weather stations throughout the State are compiled and published by the U. S. Weather Bureau. During the fire season the Weather Bureau in Missoula, Montana issues daily fire-weather forecasts which are in part also based on measurements from weather stations in the forests.

Deception Creek weather records depict rather accurately the climatic conditions required by western white pine near the center of its range in the Inland Empire region. The climate is characterized by short summer seasons during which rainfall is very scanty, temperatures are fairly high, and air humidity is low; and by long winters with snow depths of three to six feet. The average annual precipitation is about 50 inches.

On the next page is a table which summarizes the Deception Creek weather records for the years 1936 to 1945.

WEATHER SUMMARY
Deception Creek Experimental Station
1936-1945

Month	Precipitation					Temperature						
		Maximum		Minimum				Maximum			Minimum	
	Mean	Amount	When occurred	Amount	When occurred	Mean	Mean maximum	Amount	When occurred	Mean minimum	Amount	When occurred
	Inches	Inches	Year	Inches	Year	°F	°F	°F	Year	°F	°F	Year
January	5.14	9.17	1945	1.93	1942	22.4	29.1	44	1940	15.7	-32	1937
February	5.80	11.21	1940	1.94	1941	25.7	34.2	46	1938 & 1943	17.2	-36	1936
March	5.34	10.28	1945	2.17	1944	32.3	42.6	64	1941 & 1942	22.0	-18	1945
April	4.52	8.54	1937	1.09	1941	40.5	52.9	79	1939	28.0	-18	1936
May	3.67	8.46	1941	1.10	1939	49.8	64.4	92	1936	35.2	22	1939
June	3.25	6.02	1937	1.18	1940	56.0	70.8	95	1936	41.3	25	1939
July	0.77	1.43	1942	0	1945	62.8	81.7	98	1939 & 1941	44.0	30	1943
August	1.01	2.12	1937	0.04	1939	59.6	79.0	93	1940 & 1942	40.2	28	1937
September	2.86	8.41	1945	0.34	1943	54.2	70.4	93	1938	38.0	23	1937 & 1943
October	4.79	8.40	1945	1.15	1936	44.6	55.3	81	1943	34.2	18	1936 & 1942
November	6.54	14.02	1937	0.40	1936	30.8	37.0	53	1941	24.7	-13	1938
December	8.24	11.51	1939	4.51	1944	27.2	32.5	50	1941	22.0	- 2	1942
Annual	52.78					42.2	54.2			30.2		

For period 1936-1945

Maximum annual precipitation - 69.12 inches in 1945
Minimum annual precipitation - 36.69 inches in 1944
Maximum temperature - 98° F in July 1939 and 1941
Minimum temperature - -36° F in February 1936

Snow Courses

Water is of vital importance to the nation. Large sums of money are being spent to prevent the disastrous floods that yearly cause much human suffering and destroy valuable property. Many dams have been and are being built to harness the power of our rivers and to direct water to thirsty farms and cities. Much of this water comes from the high mountain watersheds. How much water accumulates in the mountains in the form of snows and how and when that snow melts are, therefore, conditions of great importance to any region. To determine how much water is stored in the form of snow, measurements are made on a network of snow courses to sample each major river basin. Data from these many snow courses are used by the Soil Conservation Service to forecast the prospective flow of water from northwest streams each spring. One of these snow courses is located on Lower Sands Creek on the Experimental Forest; another one, the Copper Ridge course, is on the Wolf Lodge Divide, just outside the forest.

The table on the next page shows snow depths and water equivalents measured on the lower Sands Creek and Copper Ridge snow courses since 1936, when measurements were started.

COPPER RIDGE AND LOWER SANDS CREEK
SNOW COURSE MEASUREMENTS

Snow Depths and Water Equivalents

Copper Ridge Snow Course

Year	January 1		February 1		March 1		April 1		May 1	
	Snow depth	Water equiv.	Snow depth	Water equiv.	Snow depth	Water equiv.	Snow depth	Water equiv.	Snow depth	Water equiv.
	Inches									
1936							94	37.1		
1937	33	9.9	63	17.0	82	28.6	87	35.2	78	37.2
1938	57	14.5	63	19.8	75	25.9	84	31.4	46	22.0
1939	38	11.2	74	22.3	104	35.8	80	34.1	45	24.4
1940	16	3.9	24	7.2	57	18.6	44	19.5	26	12.8
1941	42	9.6	53	16.9	49	17.3	35	15.3	2	1.2
1942	22	5.4	25	7.2	47	13.9	51	18.0	22	9.1
1943	54	16.6	68	21.0	80	29.4	84	34.0	50	25.0
1944	21	6.3	34	10.6	50	15.0	52	18.2	34	13.9
1945	45	9.6	45	16.6	58	21.1	91	32.8	78	31.9
1946	55	16.6	79	23.9	92	30.3	92	38.8	61	30.7
1947					48	18.3	54	20.0	20	9.3
1948					73	24.0	83	30.9	74	32.2
1949					103	40.0	106	45.5	68	37.6
1950					83	29.6	104	39.0	92	41.4
Mean	38	10.4	53	16.2	72	24.8	76	30.0	50	23.5

Lower Sands Creek Snow Course

Year	January 1		February 1		March 1		April 1		May 1	
	Snow depth	Water equiv.	Snow depth	Water equiv.	Snow depth	Water equiv.	Snow depth	Water equiv.	Snow depth	Water equiv.
	Inches									
1936							73	26.4	5	2.3
1937	16	3.7	42	9.9	59	19.2	44	18.7	21	10.9
1938	24	5.4	31	8.1	43	13.5	40	14.4	0	0
1939	16	4.5	46	11.4	67	19.1	44	16.2	0	0
1940	10	2.2	17	5.2	33	10.8	13	6.1	0	0
1941	18	4.0	32	11.3	31	10.6	12	5.8	0	0
1942	16	3.4	16	4.8	34	9.5	27	9.2	0	0
1943	33	8.2	48	13.5	53	19.0	49	18.8	6	2.5
1944	11	2.8	23	6.7	38	10.5	35	11.2	3	1.1
1945	26	5.1	33	10.2	37	12.2	41	15.5	24	9.1
1946	33	10.1	38	16.6	66	21.8	59	23.3	11	5.0
1947										
1948										
1949					71	26.9	72	31.3	31	15.8
1950					64	21.2	73	28.1	54	23.6
Mean	20	4.9	35	9.8	50	16.2	45	17.3	12	5.4

WHITE PINE AND PONDEROSA PINE PLANTATIONS
Area 10

Foresters and laymen alike frequently ask what a tree species will do away from its natural habitat. Area 10 is given over to a simple test of the growth possibilities of ponderosa pine in the white pine type on a site that from general appearances should be a favorable one for ponderosa pine.

White pine blister rust is forcing abandonment of much of the western white pine region for the growing of western white pine. Short of a blister rust resistant white pine, ponderosa pine offers the best substitute for white pine. But there is a serious question as to just how far ponderosa pine can safely be propagated away from its natural habitats and onto white pine sites. Some believe that by careful selection of seed it can be used on many areas where white pine once grew. The little test on Area 10 is one of many needed to determine the extent to which ponderosa pine can be grown in the white pine zone.

The original stand was logged in 1916 and 1917 when the land was in private ownership. All white pine was cut, leaving an unmerchantable and rather decrepit stand of grand fir, western hemlock, and some Douglas-fir and western larch. This residual stand was slashed in the early summer of 1936 and broadcast burned in the fall of the same year.

In the spring of 1937 a 5.3-acre 3 x 3 latin-square sample plot was laid out in Area 10. A 3 x 3 latin-square arrangement is much less complicated than it sounds. It means simply that three different kinds of treatments--plantings in this instance--are each replicated three times and so arranged in a rectangular tract that each treatment is repeated once and only once in each row and column of subplots within the main area. The three different kinds of plantings tested were: (1) solid ponderosa pine, (2) solid western white pine, (3) alternate ponderosa pine and white pine. All plantings were spaced 7 x 7 feet. The portion of Area 10 not in the test plot was all planted to white pine spaced 7 x 7 feet.

Ten years after planting, the trees on this area were barely visible above the dense cover of brush. Records show that about 44 percent of the trees survived the first 10 years. The two species survived about equally; ponderosa pine 41 percent and white pine 46 percent. The average height of ponderosa pine was 7.1 feet, compared with 5.6 feet for white pine. As these plantings develop over the years it will be possible to see how these ponderosa pine grow in comparison with white pine both in pure stands and in mixture where the two species are in direct competition.

Area 10 also illustrates another problem that confronts foresters in the northern Rockies. Many thousands of acres of forest land in this region badly need reforestation. Many deforested tracts

are covered with dense brush which makes planting extremely difficult. Some of the more troublesome shrubs are ceanothus, willow, wild cherry, and menziesia. Area 10 was planted before the shrubs became established so the trees were able to grow up with the shrubs and eventually overtop them. But when shrubs become well established first, drastic measures are required to prepare these lands for planting. Recently, the Timber Management Division in the U. S. Forest Service has made exploratory tests of spraying brush fields with 2,4,5-T by helicopter, then burning to clear the area for planting. This method has considerable promise for eliminating shrubs in advance of reforestation.

LOGGING ALTERNATE CLEAR-CUT AND SHELTERWOOD STRIPS
1910 and 1935 TESTS
Area 11

The Ames Creek strip cuttings deal with methods for harvesting and regenerating white pine. The original stand on Area 11 exemplified western white pine at its silvicultural and economic best. Before logging, the 160-year-old stand contained 53,000 board feet of timber per acre--about 80 percent in high quality white pine trees that averaged 21 inches in d.b.h. and six 16-foot logs per tree.

Strip cutting of western white pine was first tested on Area 11 in 1910 when, as an administrative experiment, the Coeur d'Alene National Forest sold some timber to be clear cut in strips 150 to 400 feet wide with intervening strips of uncut timber about 150 feet wide. The purchaser was Isaac Sands, then owner of the site where the Experimental Forest headquarters now stands. The white pine natural reproduction on the east side of Ames Creek came in on these 1910 strip cuttings.

The general plan of cutting was continued in 1935, though on a larger scale, by logging the west side of Ames Creek and part of the old uncut strips on the east side. On the west side of the drainage, three strips, each from 350 to 400 feet wide, extending from the creek bottom almost to the top of the ridge, were logged of all white pine. The light residual stand, mostly understory grand fir and hemlock, was felled and broadcast burned in 1936. Intervening strips, almost as wide, and a belt of timber along the top of the ridge were thinned to the extent of taking about 60 percent of the volume and 50 percent of the number of white pine trees. The understory suppressed hemlock and grand fir was felled and the slash burned along with the white pine logging slash. These operations left several clean and open white pine shelterwood strips.

Results to date of the strip cuttings in Area 11 have been satisfactory. The 1935 logging plan proved to be thoroughly practicable. Burning the cleared strips, admittedly a somewhat ticklish job, was successfully accomplished.

To determine the amount and kind of natural regeneration, a series of five transects were established on contour lines at equally spaced intervals on the slope. Along these transects the presence or absence of reproduction on 13.2-foot square quadrats (1/250 of an acre) is observed, and the total number of seedlings found on one-fourth of each 13.2-foot square is recorded. A check of these quadrats in 1950 showed that regeneration of the area is satisfactory, in both the shelterwood and clear-cut strips. Trees three or more years old of some species were found on 96 percent of the quadrats. White pine occurred on 77 percent of the quadrats in the shelterwood strips and on 68 percent in the clear-cut strips.

For the entire cutting area, 79 percent of the quadrats contained western hemlock reproduction, 73 percent had western white pine, 48 percent grand fir, 29 percent western larch, 15 percent Douglas-fir, 10 percent western redcedar, and 5 percent Engelmann spruce.

As regeneration is now satisfactory, the remaining shelterwood trees have been sold and will be logged during 1951. The final logging in 1951 will complete the regeneration cuttings on Area 11.

Losses of reserve timber, caused mainly by wind and insects, have been severe in the shelterwood strips. About 50 percent of the trees had been killed by 1950. Most of the losses occurred on the upper slopes where wind took a heavy toll. Almost all of the trees which died were salvaged because of their accessibility by roads.

Although these strip cuttings have proved to be very satisfactory for regenerating white pine and providing for its best development, strip cutting does not provide for the easiest blister rust control. The 1935 cutting occurred before blister rust became widespread through the Experimental Forest and hence the larger ribes bushes were eradicated before they had a chance to spread blister rust to the young white pine. But today this method of cutting creates an almost impossible job of protecting pine from the rust, because it makes favorable conditions for seed gemination and seedling growth of ribes as well as for pine. Before the ribes can be eradicated, they spread rust to the pine. However, broadcast spraying with 2,4,5-T gives promise of destroying the ribes at a reasonable cost within two or three years after cutting. If this promise is realized, we may be able to revert to strip cutting in certain stands.

The Blister Rust Control Office of the Bureau of Entomology and Plant Quarantine established a study plot in Area 11 in 1946 to determine the blister rust infective potential of small Ribes lacustre bushes in relation to losses of white pine reproduction. Ribes were eradicated in 1934, 1940, and 1946, by hand pulling and grubbing methods. The remaining ribes which were studied were the small, well-screened bushes missed by eradication crews. By 1950 the cumulative blister rust damage from these bushes had reached 18.7 percent of the number of white pine trees, 13.2 percent of the milacre units stocked with white pine, and 9.3 percent of the 4-milacre units stocked with pine. Though the annual loss was small, the cumulative loss was severe enough to lead to the conclusion that small ribes bushes must be eradicated.

RELEASE OF REPRODUCTION BY DISPOSAL OF VALUELESS TREES
Area 12

Back in 1916 when Area 12 was a part of the old Isaac Sands homestead, all the merchantable white pine were logged leaving a rather irregular stand composed mainly of very defective hemlock and grand fir. The stand was thinned enough by the logging, however, to permit the establishment of fairly abundant natural reproduction including considerable white pine. But the overwood was too dense for the reproduction to grow well and it developed very slowly.

To release the reproduction on this 3.9-acre area, most of the worthless residual stand was cut in May and June 1938, and the slash piled and burned. About 20 of the better overwood trees per acre were reserved along with the reproduction. The reproduction now is growing well though eventually the remaining overwood will have to be removed.

WEEDING REPRODUCTION FOLLOWING DISPOSAL OF VALUELESS TREES
Area 13

Area 13 illustrates how silviculture can mold a good white pine sapling stand from a complex mixture of reproduction which became established after a logging operation that left a defective residual overwood.

In about 1916, when this unit was in private ownership, it was logged over for white pine leaving a rather heavy residual stand of defective grand fir and western hemlock. Though green, the remaining stand was commercially without value.

Despite the rather heavy shade cast by the residual overwood, from 6 to 10 thousand seedlings per acre managed to become established, especially in the old skidways. The seedlings included between 2000 and 5000 white pine per acre. Under the shade of the overstory, which as time went on continually increased in crown density, the white pine reproduction did not fare well. In 1935 the white pine was still persisting but was largely overtopped by grand fir and hemlock which are able to grow better, relatively, than pine under shade.

In 1935, the stand was subjected to silvicultural measures designed to improve the growth and composition of the reproduction because the site is unusually productive:

1. All old hemlock and grand fir trees less than 20 inches in diameter were felled and the tops were piled and burned.

2. All grand fir and hemlock over 20 inches in diameter were girdled.

3. White pine seedlings and saplings were released by an inexpensive weeding operation that eliminated competing grand fir and hemlock.

The young white pine responded strikingly. The degree of response can best be appreciated by examining a comparable check area south of the reservoir dam. Within two years following release the white pine straightened up, assumed the blue-green color normal to healthy trees, and began growing vigorously.

A series of four sample plots, two in the treated stand and two in the untreated stand, were established in 1935 to measure results. The summary from the 1950 remeasurement of these plots shows how beneficial the silvicultural operations have been.

Treatment	Average height of white pine "crop" trees		White pine in dominant stand in 1950
	1935	1950	
	Feet	Feet	Percent
Overwood removed and reproduction weeded	4.1	20.1	71
Untreated check	4.1	8.7	12

The experiment has demonstrated three important silvicultural considerations:

1. On good sites, natural reproduction can become established in rather low light intensity--between 20 and 40 percent of full sunlight--and can survive for a considerable number of years even though growing slowly.

2. Under shade, hemlock and grand fir grow relatively better than white pine and tend to suppress the pine. In full sunlight, the reverse generally occurs.

3. Removal of overwood and release of white pine reproduction by weeding are effective stand improvement measures.

An interesting by-product was obtained from this experiment by studying the effect of girdling on hemlock and grand fir mortality and seed production. Girdled trees on Area 13 were observed periodically in considerable detail and compared with nearby ungirdled trees. Disintegration of the girdled trees was observed until 1946 when, in most instances, only short stubs remained. The study revealed that:

1. Cone production was neither increased nor decreased by girdling.

2. Trees died three to four years after girdling.

3. Disintegrating trees caused only light damage to reproduction.

4. Girdling is not advisable where large numbers of trees per acre are to be killed because of the extreme fire hazard it creates. Fuller details are given in Station Paper No. 17.

PRUNING WESTERN WHITE PINE
Area 14

Foresters have long regarded artificial pruning of trees, to produce knot-free lumber, as a desirable silvicultural measure. Declining supplies of old-growth saw timber point to difficulty in getting substantial quantities of clear lumber in the future. Western white pine, for example, yields comparatively little knot-free lumber at 100 to 120 years of age, which is commonly accepted as about the maximum age that this species will be grown in the future. Consequently, the Experiment Station has started a number of studies to determine how and when to prune. A number of these pruning tests are located on the Experimental Forest.

Several pruning tools and methods were tested on the Experimental Forest in 1936 on trees of different sizes and ages. The tool found best for pruning up to seven or eight feet from the ground, was a pistol-grip hand pruning saw with a 12-inch concave blade and eight long needle teeth per inch that cut on the draw stroke. For higher pruning, a pole saw with an 18-inch slightly concave blade and five saw points per inch that cut on the draw stroke proved best. Eight- and thirteen-foot handles were used with this saw to prune to 17 feet for one clear 16-foot log. The results of this test are given in Station Applied Forestry Note No. 76.

A test was set up in Area 14 to learn if wood-rotting fungi enter through pruning wounds. Sixteen western white pine trees were pruned, eight in the fall of 1938 and eight in the spring of 1940. The branches were pruned with a saw on each tree by three methods: severing limbs two inches from the bole, severing at the branch collar, and cutting through the branch collar flush with the bole. Two or more whorls of branches on each tree were pruned by each method. Only one method was tested on the branches in a particular whorl. Three similar plots were also established in other locations. As the pruning wounds are almost all healed over now, the trees will be dissected within the next year or two and the wood back of each pruning scar will be examined for decay.

The pruning experiments to determine if wood-rotting fungi enter through pruning wounds have already provided information on the rate of wound healing. Pruning which removed the branch collar resulted in considerably faster healing than pruning which left the branch base intact. Wounds from small branches healed faster than from large branches. Wounds resulting from the removal of live branches healed faster than wounds from dead branches. Healing was more rapid on fast growing trees of the open white pine stands, despite the larger size of the wounds, than on slow growing trees of the dense stand. No appreciable differences were evident in the extent of wound healing between spring and fall pruning. Optimum conditions for rapid wound healing

result from close pruning small live branches on rapidly growing trees. Additional information is summarized in Station Research Note No. 45.

Another test was established in Area 14 to determine the height to which western white pine trees can be pruned without seriously retarding growth. The trees at the time of pruning in 1940 were 20 to 30 years of age and were growing in a moderately open stand. Diameter breast high ranged from four to seven inches and total heights from 23 to 40 feet. Paired trees, alike in diameter breast high, height, and crown characteristics were selected. One tree in each pair was pruned and the other left unpruned as a check. Pruning ranged in severity from one-fifth to two-thirds of the live crown length. In all, 36 trees were included in the experiment.

Results at the end of the first five years of this and two similar tests at other locations have been reported in Station Research Note No. 41. The experiment showed that:

1. Removing more than 55 percent of the live crown resulted in heavy mortality, but none of the less heavily pruned trees died. Removal of about 50 percent of the live crown appears to be the safe limit from the standpoint of serious mortality.

2. Pruning one-third or less of the live crown caused no appreciable reduction in rate of height growth. However, greater live crown removal resulted in seriously decreased height growth. For example, height growth declined 36 percent when three-fifths of the crown was eliminated.

3. Pruning caused a greater reduction in diameter growth than in height growth. Removing three-fifths of the crown length caused a 73-percent drop in diameter growth. Pruning away one-fifth of the crown caused a small, temporary reduction in growth, but the growth rate had recovered at the end of five years.

The findings from the pruning tests indicate that not more than one-third of the live crown should be removed at one time.

STRIP CLEAR CUTTINGS OF 1910
Area 15

In 1910 an administrative experiment in the Coeur d'Alene National Forest included several strip cuttings. Three of these old strips are in the two small areas shown on the index map. Timber was clear cut in strips from 150 to 400 feet wide with an intervening uncut strip about 150 feet wide. Logging slash and the unmerchantable residual stand were broadcast burned. Though called strips, the cut areas actually are not much more than small patches carved out of a solid mountainside of timber which furnished an abundant seed source.

Silvicultural experience here and elsewhere has shown that clear cuttings on favorable sites (as is the case here) are conducive to optimum regeneration of white pine. Abundant natural reproduction seeded in on Area 15. Between 80 and 90 percent of the dominant trees are white pine, which grows best in the open. Trees of all species total between 1500 and 2000 per acre. Contrast this result with that described for Area 13. Fully as much white pine probably became established on Area 13 which is an equally good site but growth there was inhibited by the residual overwood and competition with the more shade-tolerant hemlock and grand fir reproduction. Many hemlock and grand fir came in on Area 15 but these species were outstripped in the open by the faster growing white pine.

As an experiment to see what might be accomplished by thinning in such stands, the upper of these two strips (Plot 33) was thinned in 1934 to leave a pure white pine stand. Subsequent thinnings and also pruning are planned.

RELEASE OF REPRODUCTION BY DISPOSAL OF VALUELESS TREES
Area 16

Until recently, good silvicultural management in the western white pine type has been seriously impeded by the poor markets for all timber except white pine sawlogs and western redcedar poles and sawlogs. What to do with the rest of the stand has been a major problem for forest managers. Area 16 furnishes a good example of this problem.

Area 16 was logged under a Forest Service timber sale contract in the winter of 1909-10. The intention was to make a rather light selective cut. Only white pine trees larger than about 14 inches in diameter were harvested. Smaller pine trees and all trees of other species were left. Slash was scattered and left unburned. Logging temporarily opened the 140- to 160-year-old stand to some extent and some seedlings became established. When examined in 1925, there were on the average 340 white pine seedlings and 1020 seedlings of other species per acre. These numbers were not satisfactory and, moreover, the overwood crowns, which had expanded considerably by 1925, cast so much shade that these seedlings were growing poorly.

The net result of the cutting was a stalemate. The white pine had been depleted by the cutting and subsequent insect attacks during the period 1910 to 1915. The space formerly held by the pine had been occupied by rather defective and valueless trees of other species. The sparse and patchy reproduction was severely shaded.

In 1938, the unsatisfactory silvicultural condition was remedied on a 6.3-acre portion of this old cutting area by removing poorer hemlock and grand fir to give existing reproduction a chance to grow and to permit establishment of new reproduction. As the material cut had no sale value, the work had to be done at a substantial deadweight expense. The treatment undoubtedly will be effective in encouraging reproduction establishment and growth. But the financial practicability and desirability of such work is doubtful. It was undertaken here to show what could be done in dealing with this silvicultural situation and to demonstrate visually a difficult utilization problem. The present policy on the Deception Creek Experimental Forest is to avoid cutting any timber currently unmerchantable--unless utterly rotten--in the hope that the vastly improved road system being developed, plus better markets for species other than white pine, will permit commercial utilization.

DISPOSAL OF LOW VALUE TREES IN ADVANCE OF LOGGING
Area 17

Some elimination of defective and low-value trees that remain following commercial logging is necessary on most white pine lands to permit satisfactory establishment and development of natural reproduction. Ordinarily, the valueless material is destroyed after logging. Here on Area 17, as an experiment, the order of events was reversed by eliminating the cull timber before commercial logging. Why not create a shelterwood stand of merchantable trees of desirable species to scatter seed for the new stand by getting rid of the undesirable trees in advance of logging? Is it possible to induce regeneration, cut the parent shelterwood stand, and leave the reproduction to grow under clear-cut conditions? Full sun, of course, is highly favorable for the growth of young white pine.

Area 17 was well suited for the test. Seventy-two percent of the original stand of 41,400 board feet per acre was western white pine and more than 90 percent of the white pine trees were merchantable by the current standards (12 inches in diameter or larger). Though most of the overwood was merchantable, there was an understory mainly of western hemlock that had no present and little prospective market value. The understory was largely responsible for the dense shade cast by the stand--shade too dense to permit seedling establishment and growth. Incidentally, the flourishing condition of this understory was in part due to thinning of the overwood by insects between 1910 and about 1915.

The experiment on Area 17 was begun in 1935. A 27-acre block about 1000 feet wide extending from the Tamarack Hill road to Deception Creek was selected and divided into two approximately equal parts. On the west half almost all trees except white pine were felled and the slash was piled and burned. The operation left a shelterwood of tall, narrow-crowned white pine trees. On the east half, trees larger than eight inches were girdled; smaller trees were felled and the slash piled and burned. Girdling is cheaper than felling and was practiced here to test the effectiveness of the method in opening up the stand and to get a rough check on the fire hazard created by the killed trees.

On one acre, all girdled trees were identified by numbered metal tags and the effects of girdling in killing the trees, on seed production and on disintegration after death, were studied until 1946. Results of this experiment have been summarized in Station Paper No. 17. Some of these are as follows:

1. Cone production was neither increased nor decreased by girdling.

2. Symptoms of vigor decline in the girdled trees first appeared nine months after girdling.

3. Girdled trees died within one to four years after girdling.

4. Girdled trees began to break off three years after girdling. Second bole breaks began six to seven years after girdling.

5. Girdling is not advisable where large numbers of trees per acre are to be killed because of the extreme fire hazard it creates.

6. Girdling is cheaper than felling and should be a useful method where scattered trees are to be killed.

The establishment of natural reproduction has been periodically determined on a series of permanent transects. A check of these transects in 1943 showed that most of the tract was very well stocked with reproduction. Only that part of the girdled area nearest the top of the hill lacked adequate white pine stocking. In 1943 there were about 950 white pine and over 10,000 seedlings of other species, mostly hemlock, per acre on the whole area. The density of reproduction on the lower half of the area is much greater than on the upper slopes.

As reproduction on this tract is now adequate, the next step in managing the stand will be to remove the overwood. It is planned to remove the overwood from half the area soon through a commercial sale. Cutting only half the overwood will allow us to compare the development of reproduction on the unit where the overwood is removed with that remaining under the shade of the overwood. Logging damage to seedlings will also be observed at the time of cutting. Following removal of the overwood, part of the reproduction stand in both the open and under the overwood will be weeded to favor western white pine.

DISPOSAL OF LOW VALUE TREES
IN ADVANCE OF LOGGING

Area 17 (continued)

Release and weeding of the reproduction was begun in 1952. A commercial logging operation removed the overwood from the west half of the area; the overwood was left intact on the east half. Each half was divided into three nearly equal parts both horizontally and vertically. Thus, there were nine blocks with the overwood removed and nine blocks with the overwood intact.

Three weeding treatments were applied to each set of nine blocks in a Latin Square design. The three treatments were: weeding to favor western white pine, weeding to favor western hemlock, and unweeded control. The blocks to favor white pine were weeded in 1953. With this design we can measure the effect of release and weeding separately and of release and weeding combined.

Growth and development of the reproduction will be followed on a one-tenth acre plot established in each block. It is planned to remove the overwood from the east side of the area in 1962.

POISONING WESTERN HEMLOCK
Area 18

Discussions of previous experiments have pointed out that defective hemlock in the western white pine type often retards the establishment and growth of more valuable but less shade-tolerant trees such as white pine, larch, and Douglas-fir, and that foresters sometimes must destroy these defective hemlock in order to release reproduction of the more valuable species. On Areas 1, 3, 4, 11, 12, 13, 16, and 17 hemlock was destroyed by felling, either followed by piling and burning or by broadcast burning. On Areas 2, 13, and 17 girdling was also tested. On this Area, number 18, another method of hemlock disposal--poisoning--was tried. Various methods of application and two poisons, sodium arsenite and ammonium sulfamate, were tested.

This hemlock poisoning experiment illustrates the pattern commonly followed in forest management research. A problem is stated; here it was to determine how to kill hemlock at low cost by the use of poison. Factors are chosen for study; in this case they were: (1) kind of poison (sodium arsenite and ammonium sulfamate), (2) concentration of poison, (3) method of application (in holes bored with an auger, in holes punched with a poisoning axe, in "cups" cut with an axe), (4) spacing of holes and cups around the tree, (5) diameter of tree (108 trees were used), and (6) season of year (fall, spring, and summer). A detailed working plan is prepared. The tests are installed; in the poisoning test on Area 18 this was done in 1947 and 1948. Results of the treatments are observed, and finally they are reported; see Station Research Note No. 79 for results of the poisoning test. Some experiments such as this one can be completed in a few years. Others require long periods of time.

Conclusions and recommendations for poisoning hemlock that resulted from the test on Area 18 are as follows:

1. Poisoning with either sodium arsenite or ammonium sulfamate effectively kills unmerchantable western hemlock.

2. Trees may be poisoned effectively in spring, summer, or fall.

3. Sodium arsenite should be applied in a 40-percent water solution in poisoning-axe holes punched at a convenient height at eight-inch intervals around the circumference of the tree, or in auger holes with a 24-inch spacing. Extreme care must be exercised in handling sodium arsenite because it is a deadly poison.

4. Ammonium sulfamate applied in crystal form in axe cups notched at a convenient height at eight-inch

intervals around the tree, or as a saturated solution in poisoning-axe holes punched at four-inch intervals, is an effective poison that is safe and easy to handle.

5. The poisoning axe was found to be much quicker and less laborious than the auger.

Poisoning is not recommended where large numbers of trees per acre are to be killed because of the fire hazard it creates. However, it is a cheap and effective method of disposing of scattered trees.

THINNING 50-YEAR-OLD WESTERN WHITE PINE
Area 19

In 1934 an intensive thinning experiment was initiated in the lower block of the two marked Area 19 on the map. In this 5.76-acre unit, which supported a very dense 50-year-old stand of white pine mixed with grand fir, Douglas-fir and hemlock, four kinds of thinning are being tested, each repeated four times in a scientifically randomized and somewhat complex sample plot arrangement. The four different kinds of thinning in the experiment are:

1. Heavy thinning from below in which the 400 best trees per acre, mostly white pine, are reserved and all others cut.

2. Heavy crown thinning in which the best 400 trees per acre are selected and given release mainly in the crowns. Noncompeting trees, including most of the suppressed understory, are left uncut.

3. Light thinning from below, leaving 800 of the best trees per acre and cutting the rest.

4. Light crown thinning in which 800 of the best trees are selected and given crown release. Non-competing trees are left uncut.

In this experiment, each thinned plot has its own adjoining unthinned check plot which, at the time of thinning, was marked exactly as if it were going to be thinned. The identity of trees that would have been cut or left had the check plots been thinned has been preserved. The method permits comparing not only total growth on thinned and unthinned plots, but growth of strictly comparable trees growing in thinned and unthinned stands. The unusual experimental design is expected to give precise results.

Results of these different kinds of thinning as obtained by an examination of the study area in 1949, 15 years after establishment, have not been analyzed. Some general observations made at the time of remeasurement were: (1) Diameter growth of trees on the thinned plots had accelerated but the total cubic-foot volume growth was probably greater on the unthinned plots; (2) crown thinnings showed about the same growth response as the thinnings from below which are much more expensive to apply; (3) the most significant advantage of thinning, to date, is a change in species composition in favor of white pine.

In 1939, an additional 2.3-acre area (just north of the plots) in the same sort of stand in which the plots are located was given a light to medium thinning from above.

The chief disadvantages of thinnings of any kind in pole-sized or larger western white pine are the lack of market for the material cut, and the high cost of the work. The latter problem can be appreciated merely by viewing the great density of the unthinned stand. If ever a pulpwood market could be developed, such thinnings would have considerable possibilities and are being studied now to get the facts necessary for this eventuality.

PRUNING AND THINNING 50-YEAR-OLD WHITE PINE FOLLOWING LOGGING OF PARENT STAND
Area 20

Forest fires do not always result in complete forest destruction, even in the western white pine type where fires are usually very hot. Ground fires sometimes creep through the forest and kill only part of the trees. Just such a fire occurred in Area 20 about 60 years ago. This fire killed about half the stand and left a fairly open shelterwood-type stand that contained about 15,000 board feet per acre, mostly white pine. Reproduction could and did develop. At 50 years of age there were about 1260 young trees per acre, averaging about four inches in diameter, of which 73 percent were white pine.

In 1938 the mature white pine that comprised 84 percent of the total volume of the residual parent stand was commercially logged. These trees were mostly fire-scarred near the base and were losing rather than gaining in net volume as a result of decay spreading from the old injuries. They were no longer needed to reproduce the area; in fact, their presence was keeping the reproduction from making best growth. Logging these mature trees naturally damaged the reproduction to some extent, but careful study showed that damage was not generally serious.

Only 20 percent of the reproduction was lost although no special precautions were required that would reduce efficiency in logging. In addition, another 16 percent of the young stand was injured to some extent (mostly by bark peeling). The loggers were careful to fell the overwood trees away from the better and larger saplings wherever practicable. Logging served as an admittedly crude but fairly effective thinning. The smaller trees received most of the damage. The interests of the loggers and the foresters were in harmony on this tract. Both wanted to remove the timber with the least amount of cutting in the reproduction stand. Of the young white pine killed in logging or so badly injured in logging that they were subsequently cut, 56 percent were killed in felling, 43 percent in skidway construction, and only one percent in actual skidding. Forty-six percent of the damaged trees were bent or knocked over, 38 percent were barked, and 16 percent had their tops broken.

Following logging, in addition to cutting down badly damaged trees and generally cleaning up the area, the stand was lightly thinned to cut out poorly formed and low value trees that were competing with good white pine. Also, from 90 to 100 per acre of the best white pine were pruned to a height of 17 feet.

Three sample plots were established on Area 20 in 1938. The primary purpose was to measure the logging damage to the understory, but the records have been kept for later measurement of

growth. Examination in 1948 showed an average of over 1600 trees per acre, of which 78 percent were white pine. Actually, only about 900 trees per acre constitute the present pole stand; the remaining trees are small saplings and seedlings that have come in since logging. In general, the stand is now vigorous and healthy. Almost all of the pruned white pine trees grew one inch or more between 1943 and 1948 which shows that the trees have benefited from the release.

The series of silvicultural operations, from logging the old trees to pruning the new, constitutes the logical completion of a natural regeneration cycle accidentally started by nature 60 years ago. This process closely resembles the shelterwood regeneration system.

DISPOSAL OF LOW VALUE TREES IN ADVANCE OF LOGGING
Area 21

This southerly and westerly slope unit of 15 acres is to be compared to Area 17, a north slope on Tamarack Hill. Before cutting, in 1936, the 140-year-old stand was comparable to those on north slopes except that grand fir and Douglas-fir were most abundant and hemlock less abundant. On both areas the unmerchantable, defective trees were felled before rather than after logging.

The purpose of this pre-logging disposal was to create shelterwood conditions favorable to natural regeneration of desirable species in advance of commercial logging. As soon as a satisfactory stand developed, the area was to be clear cut, leaving the reproduction to grow under the full sun conditions which are favorable to white pine. On the north slope unit the plan was successful, reproduction is established, and logging the overwood on part of that area is planned for 1951 or 1952.

The south slope stand has reacted less favorably. A check in 1943, seven years after the disposal cutting, showed that restocking is progressing slowly. An average of 50 white pine seedlings and 250 seedlings of other species were found per acre on the area as a whole. The west exposure portion of the tract had the highest 4-milacre stocking and the greatest number of seedlings per acre. No white pine seedlings were found on the south exposure, and only a few were found on the southwest exposure. The following table summarizes the 1943 counts.

Exposure	Four-milacre stocking		Seedlings per acre		Species composition	
	Western white pine	All species	Western white pine	Other species	Western white pine	Other species
	Percent	Percent	Number	Number	Percent	Percent
West	35	60	100	350	22	78
Southwest	5	54	45	227	17	83
South	0	33	0	167	0	100
All	13	55	50	250	17	83

Tree restocking is being severely hindered by shrubs that are invading the area. Since 1936 the shrub cover has increased so much in density that it may largely prevent further establishment of conifer reproduction, especially white pine which does not grow well under shade.

The white pine overwood on this south and west slope has suffered from extra exposure to sun and wind following cutting. In contrast

to the north slope area on Tamarack Hill, these trees have steadily declined in vigor. The volume lost annually through mortality more than offsets increment on the remaining trees.

In summary, pre-logging disposal of undesirable trees on this south slope has accelerated deterioration of the residual white pine overwood and has to date failed to produce adequate reproduction.

LOGGING ALTERNATE SHELTERWOOD AND CLEAR-CUT STRIPS
Area 22

The cutting plan adopted for Area 22 in Finger Gulch attempted to take advantage of four important silvicultural facts.

1. On moderately protected sites (as are the lower slopes of Finger Gulch), clear cutting creates the best condition for white pine regeneration and growth.

2. On fairly exposed sites, such as the upper slopes and ridge tops of Finger Gulch, white pine regenerates best under a moderately dense shelterwood stand.

3. Heaviest timber concentrations, and consequently greatest slash disposal costs, occur near the creek bottoms on most east and south slope stands like that in Finger Gulch.

4. On white pine land that bears large volumes of forest debris, natural regeneration is often unsatisfactory. The more completely the ground can be cleared, the better are chances for natural reproduction.

The lower slopes and creek bottoms in Finger Gulch were clear cut and broadcast burned but on upper slopes and ridges the timber was only thinned. In 1937, at the time of logging, only white pine, making up 65 to 70 percent of the original stand of approximately 45,000 board feet per acre, was merchantable. In the clear-cut portions, all merchantable pine trees were logged and the rather defective residual stand, mainly of grand fir and hemlock, was felled. Slash was broadcast burned in 1939. On the upper slopes, white pine was cut rather conservatively, and about 15 good seed trees per acre were left. Cutting of other species in the shelterwood portions to open the stand sufficiently to permit natural reproduction was delayed in the hope that at least part of this material could be utilized.

The heavy concentrations of fuels on the lower slopes were eliminated without handling by felling the unmerchantable residual stand on top of the slash and broadcast burning. The fire also served to prepare these lower slopes for natural regeneration. Broadcast burning in such areas is a dangerous and difficult proposition requiring much skill and judgment--as the men who fired the area well know. Burning was attempted in 1938 but the weather and fuel conditions were not right. However, it was burned successfully in the fall of 1939.

The Finger Gulch cutting has restocked slowly, and although not counted recently, regeneration probably is unsatisfactory. A series of very poor seed years followed the cutting in 1937. In addition, the summer seasons were generally too dry for germination and survival of white pine on exposed south slopes. Most south slopes in the white pine type brush in rather quickly after cutting, and Finger Gulch is no exception. The area now supports a dense cover of shrubs that may make drastic measures necessary in order to reestablish trees.

Finger Gulch is typical of most south slopes in the white pine type. Regeneration following cutting is very unpredictable; it requires a combination of good seed years and favorable weather conditions for germination and survival to establish reproduction before shrubby growth becomes dense.

The blister rust control problem is the same here as on Area 11 in Ames Creek. In the light of present knowledge we would not duplicate the Finger Gulch cutting.

LIGHT PARTIAL CUTTING IN POOR VIGOR WHITE PINE STANDS ON SOUTH SLOPES
Area 23

Foresters commonly say that there is no net growth in mature white pine stands; that is, growth is balanced by losses. However, if slow-growing, unhealthy, and dying trees, most of which are merchantable, could be harvested, many mature forests might be converted to a condition that would produce net growth. Then they could be reserved until the best time for cutting according to management requirements. Salvage of potential mortality requires, however, a permanent intensive road system that will permit light cuts anywhere on the forest property.

Development of an intensive utilization road system has been stressed on the Deception Creek Experimental Forest since its establishment. The intensive road system has made light commercial cutting a thoroughly practicable management operation. A large part of the Experimental Forest has been cut lightly on a salvage basis. All of Areas 23, 25, and 27 on the map have been cut lightly in order to harvest poor vigor and dying trees.

The first light salvage cutting of this type on the Experimental Forest occurred in 1939 on about 250 acres of Area 23 covering upper Haynes Creek and upper Hoodoo Creek. A study of this area in 1938 showed that the merchantable timber losses had been high in the previous 10 years and were still occurring. Here was a stand of such low vigor that losses greatly exceeded growth. The 1938 study indicated that between 15 and 20 percent of the total volume of live white pine trees in 1938 was contained in slow-growing and unhealthy trees that probably would die in the next 5 to 10 years.

The poor vigor trees were harvested in 1939 by a commercial logging operation that proved to be an entirely practicable enterprise. A total of 710,000 board feet in dead, dying, and unhealthy trees were cut on the 250-acre area. The cut per acre was approximately 2800 board feet. Practically all of this was western white pine as other species were not merchantable. Logging slash along roads and skid trails, and in areas of cutting concentration, was piled and burned. The balance, about 40 percent of the total, was scattered and left.

The loggers skidded the timber with horses for distances up to about 350 feet to two utilization roads built on contour from 500 to 700 feet apart on the mountainside. Timber was loaded with a jammer which also skidded logs within 100 to 150 feet above and below the roads. Logs were trucked to Coeur d'Alene, 26 miles distant, on light trucks that carried about 2600 board feet per load. Hauling was contracted at $4.50 per thousand board feet.

Another sale in 1940 removed the dead, dying, and unhealthy white pine on that portion of Area 23 not covered in 1939. Over 1.2 million

board feet of timber was removed from the area in a sale similar in nature to the one in 1939. Approximately 3.7 miles of road were constructed by the logger as a condition of the sale contract.

The block on upper Hoodoo Creek covered by the 1939 sale was reexamined in 1940. This inspection showed that mortality was continuing and that a high percentage of the merchantable white pine was of very poor vigor. It was decided to sell these low vigor white pines and also merchantable grand fir down to a 20-inch diameter limit. A second cutting in 1941, removed approximately 3000 feet of white pine and 1300 feet of grand fir per acre, and left 5600 feet per acre of white pine.

Although these two cuttings helped reduce mortality of white pine, stands in the area continued to decline in vigor, and mortality of Douglas-fir was especially severe. A third salvage cutting to remove poor risk trees got under way in 1950. About 4.4 million board feet from an area of 720 acres has been set up for cutting. The bulk of this amount is Douglas-fir and western larch. The cut per acre of all species is approximately 5700 board feet.

The series of light commercial salvage cuts in the stands on this south slope have prevented loss of much of the timber. They have failed, however, to arrest decline of the stands. In fact, the rate of decline may have been accelerated in places by the logging. They have demonstrated that partial cutting will not improve vigor in stands where vigor is very low at the time of cutting.

The eventual disposition of Area 23 has not been definitely decided. Parts of it, especially the better sites, probably should be clear cut, broadcast burned, and planted. Other parts which already have well established young growth beneath the mature stand should be kept under a continuous forest cover to suppress ribes. In these portions white pine will be replaced by other species such as grand fir. Over much of Area 23, increasingly dense herbaceous vegetation threatens to impede reestablishment of trees. Further studies are needed.

WEEDING NATURAL REPRODUCTION TO FAVOR WESTERN WHITE PINE
Area 24

Area 24, just outside the boundary of the Deception Creek Experimental Forest, but very accessible from it, was logged in 1930 as part of a Coeur d'Alene National Forest timber sale. All merchantable white pine except two to six well-formed and vigorous seed trees per acre were logged. A supplemental stand improvement operation in 1931 removed most of the residual hemlock and grand fir. All slash on the tract was piled and burned. Though many of the seed trees died, the cutting succeeded in bringing about natural regeneration, and by 1939 the area was practically fully stocked with reproduction. White pine was well represented in the young stand, but it was being overtopped and crowded by other species, particularly western larch.

In 1939 the young growth was weeded to favor white pine. The very light weeding required only 1.4 man days per acre. Only trees of equal or greater height than the better pines were removed. Three untreated check strips, each about 150 feet wide and running up and down the hill, were left for later comparison.

Stand tallies and height measurements in 1945, six years after weeding, indicated that many of the small trees, especially larch, left at the time of weeding had outgrown white pine. However, some effect of the weeding was shown by height measurements. The average height of western larch, Douglas-fir, and grand fir was less on the weeded areas than on the untreated areas. Thus white pine had a slightly better competitive position in the weeded stand than in the unweeded plots in 1945.

This test and others conducted by the Station (see Station Research Note No. 43) have demonstrated how the weeding on this area could have been made more effective. First, the weeding should have been delayed until the stand was well developed and dominance was well established, that is, until the stand attained an average age of about 10 years. In 1939 the stand on this area was only two to eight years old. Second, the weeding should have been much heavier. Third, the first weeding should have been followed by a second after three to five years to remove fast growing intolerants such as western larch.

A plot of 2.27 acres of Area 24 was weeded a second time in 1947, eight years after the first weeding. The 1947 weeding was heavy. Western larch was removed almost completely. Douglas-fir and grand fir were left only to fill holes or when less than about three-fourths the height of white pine. This heavy weeding converted the area to almost pure pine at a cost of 1.64 man days per acre.

The plot weeded in 1947 is located directly below the Fernan Lake road about one-half mile above the Experimental Forest boundary sign at the junction of five roads. The difference between the weeded portion and the surrounding stand is striking, and is readily visible from the road.

Future white pine stands within blister rust control units must contain a high proportion of good quality white pine to justify the large investment for controlling blister rust. Weedings or cleanings effectively applied will result in a high proportion of white pine at a relatively low cost.

PARTIAL CUTTING IN MATURE WHITE PINE STANDS OF POOR VIGOR
Area 25

The use of light to moderate partial cuttings as a harvesting method has become rather widespread in the western white pine region during very recent years. But back in the late 1930's and early 1940's it was only in the experimental stage. During that period the Experiment Station with the cooperation of the Forest Insect Laboratory of the Bureau of Entomology and Plant Quarantine and Forest Service Administration established a number of tests of light to moderate partial cuttings which removed poor risk trees. Area 25 is one of these tests. It should be compared with Area 27, a similar cutting on a north-facing slope.

The stand before cutting on the 220 acres included in Area 25 was mainly in the 161- to 200-year age class. The stand was unusually variable, even for a south slope, in composition, density, and vigor. It contained an average of about 15,000 board feet per acre of merchantable timber, 58 percent white pine, 19 percent western larch and Douglas-fir, and 23 percent western hemlock and grand fir. Unhealthy and defective trees of all species were marked for cutting. Because of the great variability in the stands, this marking resulted in a wide range in intensity of cut from a complete cut some places to very little cutting on others.

The timber was sold in 1942 at stumpage prices of $5.50 per thousand board feet for white pine, $1.50 per thousand for western larch and Douglas-fir, and 50 cents for western hemlock and grand fir. Cutting continued from 1942 to 1944. About a third of the stand was cut. The volume removed averaged about 5000 board feet per acre--61 percent white pine, 25 percent western larch and Douglas-fir, and 14 percent western hemlock and grand fir. Roads had been constructed in the logging area reducing skidding distances to a maximum of 1200 feet, with an average skidding distance of 500 feet. Most of the timber was skidded by horses to reduce logging damage. Skidding close to roads was by jammer.

Two sample plots (outlined in red on the map), each 3.8 acres, were established in Area 25 to check on the effect of the cutting. These were in a part of the stand which was dense and poorer in vigor than average for the whole unit. Yet they were representative of a considerable part of the area. Both plots were marked for cutting, but one plot was left uncut as a check. Individual records have been kept on each white pine tree on the plots. These records show the poor condition of the stand at the time of logging. Before cutting, 7 to 22 percent of the white pines on the plots were rated good vigor and 33 to 43 percent were of poor vigor. By comparison, the stand on Area 27 was 46 to 69 percent good vigor and 14 to 17 percent poor vigor at the time of logging. Volume of white pine per acre before cutting was 42,000 board feet for the check plot

and 34,000 board feet for the cut plot. About 63 percent of the white pine volume was removed in cutting from this latter plot.

The following table summarizes the mean annual growth and loss per acre of white pine on these plots for the first five years after logging.

Plot No.	Treatment	Increment due to growth	Loss through mortality	Net growth
		Bd.ft.	Bd.ft.	Bd.ft.
72	Uncut check	395	286	109
73	Cut	102	506	-404

Obviously, the cutting in this area was not successful in preventing mortality. In fact, the cut plot suffered a net loss of 404 board feet per acre per year for five years following cutting while the uncut plot gained 109 board feet per acre per year for the same period. If mortality on the uncut plot is considered the normal loss in this stand, the cutting actually increased mortality.

The samples probably are too small to supply accurate average growth and mortality data. On the other hand the general trends are probably relatively significant.

These results indicate that partial cutting mature white pine stands of low vigor on adverse sites may hasten the deterioration of the stand. Fortunately, most of the trees which have died in this area could be harvested through salvage cuttings.

THINNING 60-YEAR-OLD WHITE PINE
Area 26

Area 26 contains a 60-year-old stand on a lower north slope of fair site quality. The present forest originated following a fire. After the fire a tremendous number of seedlings became established. When the stand was 60 years old there were still 2470 live stems per acre one inch in diameter and larger, which is far too many for best growth at that age. Although white pines were plentiful in the stand, many were being crowded into intermediate positions by vigorous hemlock and grand fir which are aggressive white pine competitors on lower north slopes. Only 18 percent of the dominant stand was white pine before thinning in 1935. Most of the other 82 percent was hemlock and grand fir. The excessive density and undesirable species composition represented a silvicultural problem that, under good forest management, would not have been allowed to develop.

The unsatisfactory species composition was in part corrected by a rather drastic crown thinning that removed a good share of the dominant grand fir and hemlock. After thinning in 1935, white pine made up a little over 60 percent of the dominant stand. The improvement in composition was gained only by paying heavy prices in dollars and growing stock. The stand was too old for most effective treatment. Cutting required about 35 CCC man days per acre for the 21.5 acres thinned.

The thinning was primarily designed to give crown release to the individuals selected as crop trees. Many of the suppressed and dying trees were left uncut. Slash was placed as close as possible to the ground and left unburned except in fire lanes about 20 feet wide gridironing the area at 330-foot intervals. Here all slash was piled and burned.

Four sample plots, two thinned and two checks, were installed in Area 26 to measure the effect of the thinning. Trees on the check plots were marked for thinning according to the same standards used for the cut plots in order that comparable trees could be studied later. Measurement in 1940 showed that the total cubic volume growth for the first five years after thinning was greater on the unthinned plots than on the thinned plots (see table on next page).

Species	Growth in cubic feet during first five years after thinning (per acre basis)			
	Unthinned plots		Thinned plots	
	47	59	46	48
	Cu.ft.	Cu.ft.	Cu.ft.	Cu.ft.
Western white pine	90	191	174	117
Western larch	16	6	--	0
Douglas-fir	22	--	16	1
Grand fir	-47	55	0	18
Western hemlock	496	432	112	97
Alpine fir	4	--	--	--
Total	581	684	302	233

Indications are that in later measurements the check plots will continue to grow more in total cubic feet. White pine growth on the thinned plots should make a better showing as the pines on the check plots become further suppressed and those on the thinned plots respond to release. White pine generally shows the greatest growth response in the second five-year period following release.

The pines on Area 26 are now being threatened by pole blight. Although the disease has not yet reached the thinning area, it has been spreading through the stand farther up the slope for several years. Pole blight could easily nullify the effect of thinning in this area by killing the very trees that were favored in the thinning as future crop trees.

Thinnings of the kind tested on Area 26 are not yet financially feasible in the white pine type, but if markets develop for the products of thinning in the future, results of present thinning experiments will become valuable.

LIGHT CUTTING IN MATURE WHITE PINE STAND OF GOOD VIGOR
Area 27

The major purposes of partial cutting in mature white pine stands are, (1) to prevent bark beetle epidemics by cutting low vigor trees, (2) to place stands under management quicker by starting to cut sooner and by building roads, (3) to harvest potential mortality which would otherwise be lost, (4) to aid in blister rust control through suppression of ribes, and (5) to delay blister rust control action on areas where funds are at present inadequate for the blister rust control job. Area 27 is a test to determine if light partial cuttings which remove poor risk trees, can accomplish purposes 1, 2, and 3.

The stand on Area 27 before cutting was one of the best in the Experimental Forest. The volume on different parts of the tract ranged from 30,000 to 60,000 board feet per acre. About two-thirds of the total volume was white pine. From 13 to 15 percent of the white pine volume, mainly in poor risk trees, was marked for cutting.

The timber was logged in 1941. The cut on approximately 300 acres was 1,227,000 board feet of white pine, 35,000 board feet of larch and Douglas-fir, and 57,000 board feet of grand fir and western hemlock. Cut per acre ranged from 4000 to 6000 board feet. As a part of the sale contract the operator was required to build 4.6 miles of road at a cost of $1200 per mile. The stumpage price paid by the operator was $5.57 per thousand board feet for white pine, $1.55 for Douglas-fir and larch, and 55 cents for grand fir and hemlock. In addition, a deposit of a dollar per thousand was required for slash disposal. The stumpage price plus the costs of road building and slash disposal made the total cost of white pine stumpage about $11.50 per thousand board feet. After completion of the sale the operator expressed satisfaction that the operation was profitable in spite of the low volumes per acre removed.

Two sets of sample plots, two plots per set, were laid out in Area 27 to determine the results of cutting. Each of the plots in set 1, located in the lower block shown on the map, is approximately 14 acres in area. One of the plots in set 2, located in the upper part of Area 27 is about four acres in size and the other about six acres. One plot in each set was marked for cutting but left uncut as a check plot; the other plot was marked and cut as part of the sale. The study was confined to western white pine and only trees of this species were tagged. Records have been kept on each white pine individually. Fifth-year measurements on these plots gave the following figures for mean annual growth and loss.

Plot No.	Treatment	Increment due to growth	Loss through mortality	Net growth
		Bd.ft.	Bd.ft.	Bd.ft.
		Set 1		
68	Cut	377	55	322
69	Uncut check	337	185	152
		Set 2		
70	Cut	373	21	351
71	Uncut check	391	48	343

In both pairs of plots the net annual growth was greater on the cut plots than on the uncut plots for the first five years following cutting. The lower net growth on the uncut plots was due chiefly to the greater mortality on these plots. Evidently cutting was fairly successful in removing trees that would have died in the five years following cutting. An analysis of the mortality on the uncut plots showed that most of the volume lost was contained in trees of poor vigor that were marked for cutting.

This stand suffered unusually heavy mortality by wind and snow breakage during the winters of 1948-49 and 1949-50. The roads that had been built at the time of the original light cutting made it possible to salvage the mortality through commercial sales. White pine losses suffered by the plots during the winter of 1948-49 were tallied in the summer of 1949. On both sets of plots the volume lost was much less on the cut plots than on the uncut plots. Plots 68 and 70, the two cut plots, lost 3.79 percent and 2.27 percent of the 1946 volume respectively. Check plots 69 and 71 lost 5.4 and 5.39 percent of the 1946 volume. These and similar results from other tests indicate that light partial cutting on the basis of tree vigor are at least moderately successful in removing trees susceptible to windthrow or breakage.

In contrast to the poor showing of the partial cuttings in poor vigor stands on Areas 23 and 25, the cutting in the good vigor stand here on Area 27 has so far been reasonably successful in harvesting potential mortality and maintaining stand vigor.

SALVAGE OF 1948 BLOWDOWN
Area 28

A major objective on the Deception Creek Experimental Forest is to utilize the timber as closely as is economically practicable. The utilization road system has been designed to permit the salvage of dead or dying trees almost any place on the Forest. So far, almost all merchantable white pine cut in road construction has been salvaged. Previous to World War II all trees insect-attacked or otherwise dying within reach of a road were sold annually. Difficulties during and shortly after the war years forced a temporary discontinuance of this practice. During the last three years, however, salvage sales are again taking out dead and dying trees. One of them, the salvage of over 130,000 board feet of timber from Area 28 following a blowdown in 1948, is an example of the value of an intensive road system in permitting utilization of material which might otherwise be lost.

A violent wind and hail storm in early June 1948 severely damaged a small patch (Area 28) of mature timber at the top of the ridge between Deception Creek and Sands Creek. The storm left uprooted and broken trees piled like jack straws. Luckily, the damaged timber could be easily reached from one of the Forest roads.

The wind-thrown trees were salvaged through a commercial sale to one of the smaller local timber operators. The logs removed in the sale included 100,680 board feet of white pine, 13,210 board feet of Douglas-fir and larch, and 19,720 board feet of grand fir and hemlock. Stumpage payments per thousand board feet were $28.00 for white pine, $7.25 for Douglas-fir and larch, and $4.25 for grand fir and hemlock. The total return to the government was nearly $3000.

Salvage operations in 1949 and 1950 were aided by the intensive road system. Winter storms of 1948-49 and 1949-50 had treated the Experimental Forest timber roughly. Each spring numbers of wind-thrown and snow-broken trees were found. Most of this material has been salvaged. A total of 358,000 board feet of white pine timber was sold at a price of $23.00 per thousand in 1949 bringing in a total stumpage return of $8,244 plus $1.00 per thousand for slash disposal. Two sales were made in 1950. On one, 268,000 board feet of logs were sold at $25.00 per thousand for white pine, $7.70 for western larch and Douglas-fir, $1.50 for grand fir and western hemlock, and $11.60 for Engelmann spruce. Total stumpage return on this sale was $5492 plus $1.50 per thousand for slash disposal. On the other 1950 salvage sale 380.000 board feet of timber were sold at $20.00 per thousand for white pine, $2.00 for western larch and Douglas-fir, and $1.50 for grand fir and western hemlock, resulting in a total stumpage return of $6,828 plus $1.50 per thousand for slash disposal.

These salvage sales demonstrate the value of a good utilization road system in permitting prompt and easy utilization of dead and dying trees. They have also provided logs for sawmills, eliminated fire and beetle hazards, and resulted in a revenue from the forest. This all adds up to good business.

MONTFORD CREEK NATURAL AREA
Area 29

The Natural Area is the outstanding beauty spot of the Experimental Forest. Including most of the land draining into Montford Creek, a branch of Deception Creek, and covering 297 acres, it has been set aside as a sample of virgin, old-growth timber of the western white pine forest type for purposes of science and education.

Forests of several different ages occur in the Natural Area. Thirty eight acres are occupied by trees in the 41- to 80-year age class, and five acres by 120- to 160-year-old timber. A mature stand between 161 and 200 years of age covers 244 acres. The remaining 10 acres are covered with old veteran hemlock and grand fir trees more than 200 years old.

The trees include almost all the kinds found in northern Idaho forests. By far the most common is the stately, clean-boled western white pine. This species is abundant throughout the area, but especially on the lower slopes where it occurs in volumes of more than 50,000 board feet per acre. Western larch and Douglas-fir occur commonly, especially on the upper slopes. They can be found in almost pure stands in three sizeable areas on the eastern, western, and southern boundaries of the Natural Area. Grand fir and western hemlock also are abundant throughout, and in places they too form almost pure stands. Some of the hemlock-grand fir stands, which are the oldest in the Montford Creek unit, are approaching the ultimate stage in white pine forest succession when little further change in composition can occur until fire or some other catastrophe strikes and the natural succession must begin again. Alpine fir trees are numerous at the higher elevations, and lodgepole pine occurs in the southern part of the area. Scattered here and there are occasional Engelmann spruce, and search will disclose a few isolated ponderosa pines and western redcedars. Pacific yew is abundant as an understory species at many locations. Thus, 11 species of coniferous or evergreen trees are represented.

The Natural Area is also rich in subordinate vegetation. Especially beautiful are the ferns which abound near the streams. Other vegetation common to the area includes twinflower, goldthread, clintonia, Oregon grape, goatbrush, violets, princess pine, huckleberries, vine maple, serviceberry, honeysuckle, wintergreen, rose, trillium, willow, mountain ash, bunchberry, foamflower, kinnickinnick, silvergreen, alder, sarsaparilla, wild ginger, dogwood, devil's club, bedstraw, and thimble berry.

The area is readily accessible. The Wolf Lodge road traverses the southern boundary and the south side road along Deception Creek brings one to the northern tip. By far the best way to see the area, however, is to follow the Montford Creek trail

from the Wolf Lodge road to the south side road. This trail starts from the Wolf Lodge road near the Natural Area sign. It winds on an easy grade down through the continuous, old-growth stands, here and there affording a glimpse of Montford Creek, and comes out at the Natural Area sign on the south side road.

Reservation of this block as a natural area has created certain problems. Its central location in the Experimental Forest has made planning and construction of an intensive utilization road system rather difficult because all roads must stop at its boundaries. A small center of mountain pine beetle (Dendroctonus monticolae) damage was found in the fall of 1947 in the north end of the area. By 1948 the beetle population had grown to such proportions that the mature white pine stands within and adjacent to the Natural Area were endangered. Plans were made, accordingly, to remove the infested trees. These were marked for cutting and removed in 1949 by a salvage sale. Logs were skidded with horses in order to disturb the vegetation and soil as little as possible. The white pine will be closely watched, and if further damage occurs the infested trees will be removed or chemically treated to kill the beetles and stop further attacks before serious damage occurs in either the Natural Area or adjacent tracts.

SMALL MAMMALS CENSUS
Area 30

A forest community is composed of many kinds of trees, other plants, and animals which are all dependent on or affect each other in some degree. Not the least significant in this community are the small mammals such as mice and chipmunks. These animals profoundly influence important silvicultural operations. Squirrels gather cones before the seeds have scattered, and other small mammals consume tree seed after it has been disseminated. Many direct seedings have failed because small animals ate the seed. Forest plantations are frequently damaged by rabbits, mice, and gophers. Hence, it is highly important to understand the animal life of forests. Small mammals are being studied on Area 30.

The investigations in Area 30 are being conducted by a biologist assigned by the U. S. Fish and Wildlife Service to the Northern Rocky Mountain Forest and Range Experiment Station. The Area 30 project includes two tracts, with different kinds of plant cover, where small mammals are trapped to determine occurrence and abundance. The mature forest at the northern tip of the Montford Creek Natural Area is one sampling unit and the brush field in the Ames Creek alternate clear-cut and shelterwood strip cuttings is the other. In each unit are two lines of trap locations placed at 200-foot intervals. Small mammals are trapped for three consecutive nights each spring and fall. Species, numbers, sex, stomach contents, and other pertinent details are recorded.

The animals captured during the first two years of study included white-footed mice, chipmunks, meadow mice, red-backed mice, jumping mice, and shrews. The census was begun in May, 1948 in the Montford Creek Natural Area and in the fall of 1948 in the Ames Creek unit. This study is part of a wider census of small mammals in the northern Rocky Mountains which, in turn, is a part of a cooperative North American Census of Small Mammals directed by Johns Hopkins University. The results obtained here at Deception Creek can be compared with those of investigations elsewhere because standardized study methods are used.

The study on Area 30 is but one of many studies by the Fish and Wildlife biologist concerned with important forest-wildlife problems.

UNIVERSITY OF IDAHO STUDIES
Area 31

Deception Creek Experimental Forest is available as a field laboratory for research in the western white pine forest type to persons from any institution which engages in scientific investigations. Several agencies have used the Deception Creek Forest and its headquarters facilities in their research projects. Among them is the University of Idaho School of Forestry. Faculty members and students of this school have frequently conducted both short-time and long-time studies on the Deception Creek Experimental Forest. The University has several permanent sample plots on the Experimental Forest for long-time studies of white pine blister rust and white pine pole blight. Area 31 contains two of their permanent blister rust artificial inoculation plots.

One artificial inoculation plot is located in a young stand on Sands Creek and the other in one of the 1910 clear-cut strips on Ames Creek. They are parts of a study of the development of blister rust cankers on branches of western white pine following artificial inoculation. The plots were established in 1938 and the resulting "pedigreed" cankers have been observed and measured each year since. The study is giving basic information on the growth of blister rust cankers. This information provides a basis for distinguishing "killing cankers"--cankers which will kill trees--from those that will only "flag off" branches without killing their tree hosts.

In addition to the two blister rust plots, the University also has on the Experimental Forest two pole blight plots. One of these is their Disease Progress Plot No. 1, located between Area 8 and the Wolf Lodge road. Established in 1948, this is one of a number of plots set up to study the progress of pole blight in individual trees and in forest stands. Each numbered tree is measured, observed and described in detail annually. These progress plots will answer such questions as: What is the sequence of symptoms in pole blight? How long does it take pole blight to kill a tree after symptoms are first detected? Does a tree ever recover once it has been attacked?

The other pole blight plot, established in 1949, is a test to see if pole blight can be prevented by fertilizing the soil. This plot is located above the road just west of Area 5 in a healthy stand of white pine which is not far away from a badly pole blighted stand. The elements added to the soil were nitrogen, calcium, and boron, which previous foliar analyses had shown to be present in less than normal quantities in pole blighted trees. No effect of the fertilizers was evident in 1950 because pole blight had not yet attacked the fertilized trees.

WHITE PINE BLISTER RUST
Area 32

No one can discuss the management of western white pine for long without considering the impact of blister rust. White pine cannot be managed, cannot exist in numbers, unless blister rust is controlled. That is why blister rust so often receives major attention in discussions concerned with western white pine forestry. Here on the Experimental Forest it is considered in every forestry operation. Hence Area 32 includes the whole Experimental Forest.

White pine blister rust is a comparatively recent invader on the Experimental Forest. Although an infection in a pole stand at the mouth of Burnt Cabin Creek, a few miles to the north, was one of the first found in the Inland Empire, a blister rust canker was not found within the Experimental Forest until 1936, and then a detailed reconnaissance revealed only one canker. But by the end of 1941, a so-called "wave year" for the spread of rust, the disease was widespread and common within the Experimental Forest.

Efforts to control blister rust preceded arrival of the disease by several years. Ribes eradication work began on the Experimental Forest in 1927 when crews hand pulled bushes on 2639 acres. In 1928 some 1523 acres were covered, part of which was a rework of areas covered in 1927. In 1933 and 1934 about 1696 acres were treated, reworking some of the 1927 coverage and also working new ground not previously covered. With this work all of the Experimental Forest had been covered once. These extensive early ribes eradication programs probably substantially retarded the first appearance of blister rust. Rework during the following years was as follows: 1939--423 acres, 1940--247 acres, 1946--555 acres, 1949--321 acres, 1950--734 acres.

Severe damage has occurred in the pole stands of Area 5 on upper Sands Creek and Area 26 on upper Deception Creek where white pine stocking has been or will be reduced about 30 percent by killing infections. Stands of Area 19 on Demorest Creek have incurred a 14-percent reduction in stocking, and the natural reproduction of Area 11 on Ames Creek shows about 22 percent reduction. The plantations of Area 1 are practically free of rust.

Despite rather substantial blister rust damage, the rust situation on the Experimental Forest is strikingly better than in some nearby drainages where the pines have been riddled by rust because the ribes were not eradicated. Blister rust control facilities are not great enough to adequately protect all white pine forests.

The Experiment Station has cooperated with the Office of Blister Rust Control, Bureau of Entomology and Plant Quarantine, on a number of white pine blister rust studies and has encouraged use

of the Deception Creek area for that purpose. The Office of Blister Rust Control has studied the effect of most of the silvicultural treatments used at Deception Creek on the establishment and growth of ribes. A study of small Ribes lacustre bushes is mentioned in the write-up for Area 11. A cooperative study of control is now in progress in Snyder Creek just west of Ames Creek. Ribes will be sprayed with plant growth hormones following shelterwood cutting and clear cutting. Slash will be broadcast burned on the clear-cut unit. A cooperative report, Station Paper No. 3, sums up present knowledge on blister rust control in the management of western white pine. Another Station Paper, No. 16, describes an economic analysis of blister rust control and offers a blister rust control policy for national forests.

HARVEST CUTTING BY CLEARCUT AND SEED TREE METHODS

Area 33

This 60-acre tract in the Snyder Creek drainage is being used for a number of white pine research projects including (1) control of ribes following clearcut and seed-tree regeneration cuttings, (2) testing growth and form characteristics of white pine hybrids, (3) growth and yield of trees planted at various spacings, (4) the effect of burning on the growth of seedlings, and (5) the rate of fire hazard reduction following various slash disposal methods.

The original purpose of the cutting was to test, in cooperation with the Blister Rust Control Division, eradication of ribes following two methods of harvest cutting. The two harvest cutting methods used on this tract are clearcutting followed by prescribed broadcast burning and planting, and seed tree cutting.

Area 33 is divided into two units. Unit I contains the upper 40 acres and Unit II the lower 16 acres of the Snyder Creek drainage. In Unit I all of the merchantable timber was logged during the summer of 1951. The residual unmerchantable trees were felled in the fall of 1951 and the spring of 1952. Then in September 1952 the logging slash was broadcast burned. The slash was burned to dispose of the fire hazard; the burn was not intended to destroy ribes.

The ribes were sprayed with 2,4,5-T in the fall of 1954. The unit was checked and the remaining live ribes sprayed in 1955. Another check will be made in 1956 to be sure the ribes have been eliminated. The unit will be planted with western white pine trees in the spring of 1957.

When Unit II was logged in 1951, a shelterwood of white pine, approximately 10,000 bd.ft. per acre, was reserved as a seed source; all remaining merchantable

timber was cut. The logging slash was piled in 1952 and burned in 1953. All residual understory hemlocks were felled and the resulting slash piled in 1954. The piles were burned in 1955. Ribes on Unit II will be eradicated in 1956 to protect the natural reproduction from the white pine seed trees.

As stated above, the treatments applied to Snyder Creek created conditions favorable for several other research projects. For example, 10 acres of Unit I are being used to test white pine hybrids. The Division of Blister Rust Control of the Northern Region of the Forest Service and the Inland Empire Research Center are working jointly to develop strains of western white pine trees resistant to blister rust. At the same time they are developing trees with superior growth rate and form. The 10-acre tract in Snyder Creek is being used to test the growth and form characteristics of a number of hybrids which exhibit some degree of resistance to blister rust.

The white pine plantation planned for Unit I of Area 33 will include several different spacings. A series of sample plots will be established to test the effects of different spacings on growth, form, and quality of individual trees as well as the growth and development of the stands.

The University of Idaho is using Area 33 to test the effect of various degrees of burning on the growth of tree seedlings.

Three acres of Unit II are being used by the University of Idaho and the Fire Research Division of the Intermountain Forest and Range Experiment Station to test several methods of slash disposal. The purpose of these tests is to determine the rate of fire hazard reduction following the various disposal methods.

PLANTING FOLLOWING BROADCAST BURNING ON SOUTH SLOPES

Area 34

Before cutting in 1955, the timber stand on Area 34 was similar to the one on Area 23, composed mostly of overmature white pine and Douglas-fir trees, many of which were of poor vigor. On Area 23, we are attempting to hold the stand and protect the site by making periodic light cuts which remove trees of poor vigor. In contrast to this treatment, Area 34 will test clearcutting followed by prescribed broadcast burning and planting.

Area 34 consists of two units totaling 126 acres on the upper slopes of Demorest Creek. Unit I includes 56 acres at the top of the drainage from which all merchantable timber was logged in 1955. The residual unmerchantable trees were felled during the summer of 1956, and the slash was broadcast burned in September 1956. Three years after burning, ribes will be eradicated from the unit. Western white pine, grand fir, and Douglas-fir seedlings will be planted the year after ribes are eradicated.

The clearcutting and planting treatment being applied here is similar to that on Unit I of Area 33, but the site is different. Area 34 is a more severe site than the north-facing exposure in Snyder Creek. Under conditions present on Area 34 burning may be more injurious to the soil and survival of planted stock will be more uncertain. Many white pine management units contain sites similar to this from which ribes must be eliminated to protect the rest of the unit from blister rust. We need to know whether it is better to apply intensive management to these exposed sites and attempt to grow a maximum volume of white pine or to apply measures which will keep the site covered with a mixed stand, keep the ribes problem at a minimum, and concentrate the management of white pine on the better sites. The results of the tests

being conducted here will help answer those questions.

Unit II of Area 34, before cutting, contained scattered overmature trees with sparse to dense stands of pole-sized trees in the understory. The scattered overwood was logged in 1955 to release the young stand. Sale area betterment money obtained from the sale will be used to improve composition and spacing in the pole stand.